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British Museum (Natural History)

Nomenclatural studies on the British Pompilidae (Hymenoptera)

M. C. Day

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Nomenclatural studies on the British Pompilidae (Hymenoptera)

M. C. Day

Department of Entomology, British Museum (Natural History), Cromwell Road, London SW7 5BD

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Synopsis

Type-material of north-west Palaearctic species of Pompilidae has been examined in order to determine the correct application of names of the 41 species that comprise the pompilid fauna of the British Isles. Particular attention has been given to the identity of type-species of genera and the consequent application of generic names. The priority of various competing suprageneric names has been established. The identity of the genus *Aporus* Spinola is discussed in detail and action taken to stabilize the name in its current sense. Two genus-group names and ten species-group names are newly synonymized; one genus-group name and three species-group names are recalled from synonymy. One new species (previously misidentified) is proposed and 18 lectotypes are designated; one new combination is established. Two species are newly recorded from Britain and a revised check list of British species is given. Six extra-limital species are treated.

Introduction

The Pompilidae are spider-hunting fossorial wasps of predominantly tropical distribution, but with some 41 species in the British Isles. They are not commonly encountered, are relatively difficult to capture and have a markedly homogeneous general morphology. It is thus not surprising that these wasps have been poorly understood and frequently misidentified. However, in recent decades real progress has been made in the recognition of species as biological entities and in the correct association of sexes. The significance of particular morphological characters is now better understood, and it is possible with reasonable certainty correctly to identify the type-material of early authors in order to stabilize nomenclature. Unfortunately, few past students have attempted exhaustively to locate and identify such material. This is not to say that these studies have been neglected; but they have been fragmentary and progress has thus been arbitrary rather than systematic. The imminence of a revised edition of the Hymenoptera part of the *Check List of British Insects* has prompted the re-examination of type-material of early authors, and the results are presented here. Designation of lectotypes where necessary and the presentation of unambiguous synonymies will, I hope, clarify the nomenclatural history of many names; unfortunately, many past synonymic lists have not adequately differentiated between original descriptions, subsequent citations, homonyms and misidentifications. I hope that the work can eventually be expanded in order to lay a sound nomenclatural base for future work with the larger southern Palaearctic fauna. Particular attention has been paid to the application of generic names; this has necessitated the study of some tropical forms. The designation of lectotypes for the type-species of some genera here suffices to stabilize existing usages, some of which have been in doubt.

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The classification of the Pompilidae presents many difficulties, and it is not realistic to suppose that the one employed here will remain unaltered in the future. In particular the Palaearctic species are grouped in many subgenera, some of which may achieve generic status when the world fauna is better understood, others of which may be reduced to the status of species-groups. I support the approach of Bohart & Menke (1976), who employ no subgenera in their classification of world Sphecidae. However, for the present I have used existing subgeneric names in conformity with current usage.

As with subgenera, so with subspecies; the Palaearctic fauna, more than any other, has many species for which a multiplicity of names designate various colour, geographic and morphological variants. I am not convinced that this a desirable practice, since it overburdens our nomenclature and thus expands the primary task of taxonomists working at the species level. It can hardly be of value to other biologists, who are often in doubt as to which species confronts them in the first instance. I have thus dispensed with trinomials; I hope to present more detailed arguments elsewhere. Suffice it to say that, whilst I believe it proper to describe variation and to key species adequately in that context, I do not believe there to be any overall benefit in applying formal infraspecific names.

Species not here recorded in their synonymies as listed in Kloet & Hincks (1945), or not otherwise stated to occur in Britain, are exotic.

The names of institutions in which material studied is housed are herein abbreviated as follows.

BMNH	British Museum (Natural History), London, United Kingdom.
CLS	Collection of the Linnean Society, London, United Kingdom.
IRSNB	Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium.
MIZSU	Museo ed Istituto di Zoologia Sistematica dell'Università, Turin, Italy.
MLU	Martin-Luther Universität, Halle-an-der-Saale, East Germany.
MNHN	Muséum National d'Histoire Naturelle, Paris, France.
MNHU	Museum für Naturkunde der Humboldt-Universität, Berlin, East Germany.
NM	Naturhistorisches Museum, Vienna, Austria.
NMHN	National Museum of Natural History, Prague, Czechoslovakia.
NMV	National Museum of Victoria, Melbourne, Australia.
NR	Naturhistoriska Riksmuseum, Stockholm, Sweden.
RNH	Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands.
TM	Természettudományi Múzeum, Budapest, Hungary.
UM	University Museum, Oxford, United Kingdom.
UZI	Universitetets Zoologiska Institution, Lund, Sweden.
UZM	Universitetets Zoologiske Museum, Copenhagen, Denmark.
ZI	Zoological Institute, Leningrad, U.S.S.R.
ZMU	Zoological Museum of the University, Helsinki, Finland.

The nomenclature of the British Pompilidae

Family **POMPILIDAE** Latreille

Pompilii Latreille, 1805 : 277. Type-genus: *Pompilus* Fabricius, 1798 : 212.

Subfamily **PEPSINAE** Lepeletier

Pepsites Lepeletier, 1845 : 464. Type-genus: *Pepsis* Fabricius, 1804 : 207.

Tribe **PEPSINI** Lepeletier

Pepsites Lepeletier, 1845 : 464.

Genus ***CRYPTOCHEILUS*** Panzer

Cryptocheilus Panzer, 1806 : 120. Type-species: *Sphex annulata* Fabricius, 1798 (junior primary homonym of *Sphex annulata* Lichtenstein, 1796) [=*Pompilus comparatus* Smith, 1855], by subsequent designation (Westwood, 1840 : 82).

Calicurgus Brullé, 1833 : 364. Type-species: *Sphex annulata* Fabricius, 1798 (junior primary homonym of *Sphex annulata* Lichtenstein, 1796) [= *Pompilus comparatus* Smith, 1855], by monotypy. [Synonymy with *Cryptocheilus* by Pate, 1946 : 78.]

Under current provisions of the *International Code of Zoological Nomenclature*, *Cryptocheilus* is clearly to be treated as of masculine gender.

Various subgeneric names are employed for components of the European fauna, of which only one is represented in Britain.

Subgenus *ADONTA* Billberg

Salius Fabricius, 1804 : 124. Type-species: *Sphex sexpunctata* Fabricius, 1794 [= *Sphex versicolor* Scopoli, 1763], by subsequent designation (Guérin-Méneville, 1849 : 316). [Junior homonym of *Salius* Schrank, 1798.]

Adonta Billberg, 1820 : 101. [Replacement name for *Salius* Fabricius.]

Cryptocheilus* (*Adonta*) *notatus (Rossius)

Sphex notata Rossius, 1792 : 127. Type-material not located, presumed lost, ITALY. [Name first used in *Cryptocheilus* by Šustera, 1924 : 86, 96.]

Pompilus affinis Vander Linden, 1827 : 337. Type-material not located, presumed lost, BELGIUM. [Synonymy suggested by Šustera, 1924 : 86, 96.]

Cryptocheilus affinis (Vander Linden); Kloet & Hincks, 1945 : 318.

Recent European authors recognize three so-called subspecies: *C. n. notatus* (alpine and Mediterranean) with red coloration restricted to a patch on the second tergum; *C. n. affinis* (Vander Linden) for the northern (including British) forms, with red on the first three terga; and *C. n. melanius* (Lepeletier) (Mediterranean) with no red colour. I see no value in trinomials for such colour variants and prefer to use the simple binomial.

Cryptocheilus* (*Adonta*) *versicolor (Scopoli)

Sphex versicolor Scopoli, 1763 : 295. Type-material lost, YUGOSLAVIA.

Priocnemis variabilis (Rossius); Smith, 1858 : 70.

Smith recorded a female specimen from South Wales. I have seen a specimen in BMNH so labelled; it is a female *C. versicolor* (Scopoli), undoubtedly mislabelled as to provenance.

Genus ***PRIOCNEMIS*** Schiødte

Priocnemis Schiødte, 1837 : 324. Type-species: *Sphex exaltata* Fabricius, 1775, by subsequent designation (Westwood, 1840 : 82).

Subgenus ***PRIOCNEMIS*** Schiødte

Priocnemis Schiødte, 1837 : 324.

Priocnemis* (*Priocnemis*) *agilis (Shuckard) **sp. rev.**

[*Pompilus exaltatus* (Fabricius) var. B sensu Vander Linden, 1827 : 334. Misidentification.]

[*Pompilus exaltatus* (Fabricius) var. B sensu Shuckard, 1837 : 67. Misidentification.]

Pompilus agilis Shuckard, 1837 : 251. LECTOTYPE ♀, GREAT BRITAIN (BMNH), here designated [examined].

Priocnemis obtusiventris Schiødte, 1837 : 329. Type-material not located, presumed lost, DENMARK.

Priocnemis agilis (Shuckard); Dahlbom, 1842 : 10. [Lists *P. obtusiventris* as a synonym.]

Priocnemis obtusiventris Schiødte; Dahlbom, 1843 : 115. [Lists "*Pompili exaltati* var. *agilis* Shuck." as a synonym.]

Priocnemis obtusiventris Schiødte; Kloet & Hinks, 1945 : 318.

P. agilis Shuckard. Shuckard's collection is lost; however, he examined material from many contemporary collections, including that of Stephens. One of several females of *P. agilis* in the BMNH collection, each originally from Stephens, bears a printed label 'agilis'. There is no positive evidence that the specimen was extant at the time of description but, in the absence of evidence to the contrary, I have labelled and here designate as lectotype the specimen referred to above.

P. obtusiventris Schiødte. Material from Schiødte's collection in Copenhagen bears no locality data or date and is thought by Drs Petersen and Lomholdt to post-date description. I have seen a female and male which agree with the description and long-standing interpretation of this species.

An advertisement on the flyleaf of Shuckard's work gives strong presumptive evidence that the work was published before 1st May, 1837, and probably before 1st March, 1837. Richards (1935 : 160) quotes F. J. Griffin, who gives as the date 2nd January, 1837. Schiødte's paper was published in the third of four parts of Krøyer's *Naturhistorisk Tidsskrift*; in the absence of any inferential evidence, it must be presumed to date from 31st December, 1837. Shuckard's name thus has priority.

Priocnemis* (*Priocnemis*) *cordivalvata Haupt

Priocnemis cordivalvatus Haupt, 1927 : 120. LECTOTYPE ♂, GERMANY (EAST) (MLU, Halle), here designated [examined].
Priocnemis cordivalvatus Haupt; Kloet & Hinks, 1945 : 318.

Haupt described from a male and four female syntypes, of which I have seen all save one female. Two females and the male each bear Haupt's determination label and an orange-brown 'Type' label. I have labelled and here designate as lectotype the male specimen, which has been figured.

Priocnemis* (*Priocnemis*) *exaltata (Fabricius)

Sphex exaltata Fabricius, 1775 : 351. LECTOTYPE ♀, EUROPE ('Habitat in Europa') (UZM, Copenhagen), here designated [examined].
Sphex revo Harris, 1780 : 95, pl. 28. Type-material not located, presumed lost, GREAT BRITAIN. [Synonymy in Dalla Torre, 1897 : 221.]
Priocnemis exaltatus (Fabricius); Kloet & Hincks, 1945 : 318.

Richards (1935 : 159) examined four possible syntypes, three females and a male, all of which are conspecific. Van der Vecht has labelled as lectotype the sole female bearing a determination label (possibly not in Fabricius's hand). I have labelled and here designate as lectotype the same female specimen, which agrees with current interpretation.

Priocnemis* (*Priocnemis*) *fennica Haupt

[*Priocnemis notatus* (Rossius) var. B sensu Schiødte, 1837 : 327. Misidentification.]
[*Salius* (*Priocnemis*) *notatulus* Saunders, 1896 : 68; ♂, partim. Misidentification.]
Priocnemis femoralis forma *fennica* Haupt, 1927 : 113. Lectotype ♀, FINLAND (ZMU, Helsinki), by designation of Wolf (1967 : 21) [examined].
[*Priocnemis femoralis* (Dahlbom) sensu Šustera, 1938 : 204. Misidentification.]
[*Priocnemis femoralis* (Dahlbom) sensu Kloet & Hincks, 1945 : 318; partim. Misidentification.]
Priocnemis fennica Haupt; Blüthgen, 1952*b* : 15.

Haupt refers to a female and a male in Nordström's collection and a female from Parnå in Forsius's collection. In the collections at Helsinki are a female and male from Karislojo (collected by *Forsius*) and a female from Parnå (collected by *Nordström*). Haupt appears to have confused collectors and localities. Wolf designated as lectotype the female from Parnå, collected by Nordström; this specimen bears Wolf's label.

A female and a male in the collections in Prague bear Šustera's labels; they agree with Blüthgen's account of Šustera's interpretation (see also notes under *P. hyalinata*).

This species is here recorded as a British insect for the first time (see also under *P. hyalinata*).

Priocnemis* (*Priocnemis*) *gracilis Haupt

Priocnemis gracilis Haupt, 1927 : 120. Lectotype ♀, GERMANY (EAST) (MLU, Halle), by designation of Wolf (1963 : 134) [examined].
Priocnemis gracilis Haupt; Kloet & Hincks, 1945 : 318.

Haupt described from five females and two males. Wolf designated a female 'lecto-holotypus', although the male subgenital plate had been figured by Haupt.

Priocnemis* (*Priocnemis*) *hyalinata (Fabricius) **comb. n.**

Sphex hyalinatus Fabricius, 1793 : 212. Holotype ♂, EUROPE (UZM, Copenhagen) [examined].
[*Pompilus notatus* (Rossius) sensu Vander Linden, 1827 : 317. Misidentification.]
Pompilus femoralis Dahlbom, 1829 : 13. Lectotype ♂, SWEDEN (UZI, Lund), by designation of Blüthgen (1952*b* : 14) [examined]. **Syn. n.**
Priocnemis femoralis (Dahlbom); Dahlbom, 1843 : 109; ♂.
Salius (*Priocnemis*) *notatulus* Saunders, 1896 : 68; pl. 10, fig. 1. LECTOTYPE ♂, GREAT BRITAIN (UM, Oxford), here designated [examined]. **Syn. n.**
Priocnemis femoralis (Dahlbom); Haupt, 1927 : 111.
Priocnemis pseudofemoralis Šustera, 1938 : 204. LECTOTYPE ♀, CZECHOSLOVAKIA (NMNH, Prague), here designated [examined]. [Synonymy with *P. femoralis* by Blüthgen (1952*b* : 13).]
Priocnemis femoralis (Dahlbom); Kloet & Hincks, 1945 : 318; partim.

Sphex hyalinata F. A single male stands under this name in the Fabrician collection in Copenhagen; it bears a hand-written label, 'hyalinata'. Although in poor condition, it is readily identifiable as the species of *Priocnemis* here treated. Previously, the name has been used as a valid name for *Caliadurgus fasciatellus* (Spinola), q.v.

P. femoralis Dahlbom. The single male, in good condition, bears a red 'typ' label and a label in Dahlbom's handwriting, 'Pr. femoralis Dlbm (notatus V.D.L., Sch, Shuck *non* Sph. notata Rossi)'. The label must post-date description but this need not exclude the specimen from status as primary type. Blüthgen designated this specimen 'lecto-holotypus' (1952*b* : 15); it is not so labelled and need not have been so designated.

S. notatulus Saunders. Saunders proposed this name as a 'nom. nov.' for '*Salius notatus* of authors, nec Rossi'. It is clear from the description that he did not discriminate the two components of his mixed species, *P. hyalinata* and *P. fennica.* The figure clearly is of a male of the species here called *hyalinata.* Only one specimen of many of both sexes in the collections at Oxford bears a label in Saunders's handwriting, 'Salius notatulus ♂'; it is a male of *P. fennica.* I have labelled and here designate as lectotype the male specimen that agrees best with Saunders's figure (pl. 10, fig. 1); the name thus falls as a synonym of *hyalinata.* I have not sought to identify and label all possible paralectotypes.

P. pseudofemoralis Šustera. I have examined 37 females and 41 males from the collections in Prague. Two females and seven males are of *P. fennica*, 31 females and 34 males are of *P. hyalinata*, and four females are of other species of *Priocnemis.* Several specimens were collected subsequent to Šustera's description and must be excluded from syntype status. Of the balance, several bear determination labels in Zavadil's handwriting. Only one specimen of each sex bears a label in Šustera's handwriting, 'Priocnemis pseudofemoralis Šust. ♀', and the same, '♂'. Both agree with the interpretation of Blüthgen (1952*b*) and the details given by Šustera. I have labelled and here designate as lectotype, the female bearing Šustera's label; this bears data 'CSR MORAVIA HRANICE V. ZAVADIL 7.7.1924'. I have labelled as paralectotype the male which bears Šustera's label and data 'CSR MORAVIA BZENEC V. ZAVADIL 28.7.1927'. I have labelled no further paralectotypes, though many of these specimens have such status. See also notes under *P. fennica.*

Priocnemis* (*Priocnemis*) *parvula Dahlbom

Priocnemis parvulus Dahlbom, 1845 : 460. Lectotype ♂, SWEDEN (UZI, Lund), by designation of Valkeila (1961 : 3) [examined].
[*Priocnemis minor* (Zetterstedt) sensu Kloet & Hinks, 1945 : 318. Misidentification.]

Valkeila (1960 : 232) invalidly designated as 'lectotype' a female specimen from Dahlbom's collection; Dahlbom had described no female. In 1961 (p. 3) he designated as lectotype a single male specimen which bears Dahlbom's labels, which was in any case presumptive holotype.

Priocnemis* (*Priocnemis*) *propinqua (Lepeletier)

Calicurgus propinquus Lepeletier, 1845 : 410. LECTOTYPE ♀, FRANCE (MNHN, Paris), here designated [examined].
Priocnemis propinquus (Lepeletier); Kloet & Hinks, 1945 : 318.

Three conspecific female syntypes stand in the collection in Paris. I have labelled and here designate as lectotype the specimen which now bears Lepeletier's label.

As a British insect, this species is known only from two specimens collected by Miss Chawner in the New Forest before the turn of the century. One is in the UM, Oxford, the other in the collections of the British Entomological and Natural History Society. The male of this species is not yet described, though many females have been collected in northern France and Belgium (R. Wahis, personal communication). The possibility that this species is thelytokously parthenogenetic should not be ignored.

Priocnemis* (*Priocnemis*) *pusilla Schiødte

Priocnemis pusillus Schiødte, 1837 : 327. Type-material not located, presumed lost, DENMARK.
Priocnemis pusillus Schiødte; Kloet & Hincks, 1945 : 318.

I have seen two males from the Schiødte collection in Copenhagen which probably post-date description. They conform to current interpretation of the species.

Priocnemis* (*Priocnemis*) *schioedtei Haupt

Priocnemis schiödtei Haupt, 1927 : 119. Syntypes ♀♂, EUROPE (MLU, Halle) [examined].
Priocnemis schiödtei Haupt; Kloet & Hincks, 1945 : 318.

There is considerable ambiguity with regard to the type-material of this taxon. Haupt described from three females from localities in East and West Germany and a male from Innsbruck; he figured the male subgenital plate. I have seen a *female* from Innsbruck (labelled 'holotypus' by Haupt), a female from Manebach (one of the localities cited by Haupt) and a male of uncertain origin. The male bears an 'allotypus' label and a collection date post-dating description. I prefer to leave designation of a lectotype until the status of this male can be clarified.

The Manebach female bears other labels: 'holotypus', 'Priocnemis ambiguus ♀ Haupt det. 1943', 'schiödtei HAUPT var ambiguus HPT i. l. Heinrich Wolf det. 196'. This name was published by Wolf (1963 : 130) as '*Priocnemis schiödtei* var. *ambiguus* (Haupt i. l.) n. var.'. The name is unavailable under either alternative of the *International Code of Zoological Nomenclature* (Article 45d, name proposed expressly for a variety).

Subgenus ***UMBRIPENNIS*** Junco

Umbripennis Junco, 1946 : 145. Type-species: *Sphex fusca* Linnaeus sensu Fabricius, 1775 (misidentification) [=*Sphex perturbator* Harris, 1780].

Priocnemis* (*Umbripennis*) *coriacea Dahlbom

Priocnemis coriaceus Dahlbom, 1843 : 103. Holotype ♂, POLAND (UZI, Lund) [examined].
Priocnemis coriaceus Dahlbom; Kloet & Hinks, 1945 : 318.

The single male in Lund bears Dahlbom's labels and agrees well with the description and with current interpretation.

Priocnemis* (*Umbripennis*) *perturbator (Harris)

[*Sphex fusca* Linnaeus sensu Fabricius, 1775 : 349 (partim). Misidentification.]
Sphex perturbator Harris, 1780 : 95, pl. 28. Type-material not located, presumed lost, GREAT BRITAIN.
Pompilus sepicola Smith, 1851 : 14. LECTOTYPE ♀, GREAT BRITAIN (BMNH), here designated [examined]. **Syn. n.**
Priocnemis perturbator Harris; Kloet & Hincks, 1945 : 318.

S. perturbator Harris. No material of Harris's survives. It is probable that he had material of two closely related species, *P. perturbator* and *P. susterai* Haupt. However, I believe that workers will continue to follow current interpretation of Harris's species without the need to designate a neotype specimen; *P. perturbator* is the most widely distributed of the two in the British Isles.

P. sepicola Smith. Smith proposed *P. sepicola* for the species misidentified by Fabricius as *Sphex fusca* Linnaeus, following an examination of the Linnaean material of the latter in Burlington House. He stated that *P. sepicola* was widely distributed. One female specimen in the BMNH and three females ex Smith's collection, now also in BMNH, may be regarded as original syntypes. Further specimens ex Stephens's and Hope's collections might also be so regarded. Specimens both of *P. perturbator* and *P. susterai* are represented. I have labelled and here designate as lectotype the female from BMNH collections first mentioned, which is a specimen of *P. perturbator* as currently understood. *P. sepicola* thus falls as a synonym, preserving usage of *P. susterai.*

Priocnemis* (*Umbripennis*) *susterai Haupt

[*Sphex fusca* Linnaeus sensu Fabricius, 1775 : 349 (partim). Misidentification.]
[*Pompilus sepicola* Smith, 1851 : 14 (partim). Misidentification.]
Priocnemis susterai Haupt, 1927 : 97; ♂. Lectotype ♂, GERMANY (EAST) (MLU, Halle), by designation of Blüthgen (1952*a* : 129) [examined].
Priocnemis clementi Haupt, 1927 : 100; ♀, ♂. Lectotype ♂, AUSTRIA (MLU, Halle), by designation of Blüthgen (1952*a* : 130) [examined]. [Synonymy by Blüthgen (1952*a* : 129).]
Priocnemis clementi Haupt; Perkins, 1945 : 153. [British record.]

The females associated by Haupt with the male of *P. susterai* are females of *P. enslini* Haupt. The females and males described as *P. clementi* are conspecific.

Genus ***CALIADURGUS*** Pate **nom. rev.**

Calicurgus Lepeletier, 1845 : 397. Type-species: *Pompilus fasciatellus* Spinola, 1808, by subsequent designation (Kohl, 1884 : 45). [Junior homonym of *Calicurgus* Brullé, 1833 : 364.]
Caliadurgus Pate, 1946 : 78. Type-species: *Pompilus fasciatellus* Spinola, 1808 (not *Sphex hyalinata* Fabricius as stated by Pate). [Replacement name for *Calicurgus* Lepeletier.]
Calicurgus Lepeletier; Townes, 1951 : 915.

Pate proposed *Caliadurgus* as a replacement name for *Calicurgus* Lepeletier, citing '*Sphex hyalinata* F.' as type-species. However, *S. hyalinatus* F. is a species of *Priocnemis*. Pate's genus, proposed expressly as a replacement name for a junior homonym, has *ipso facto* as type-species that of the genus-name replaced; in this case, *P. fasciatellus* Spinola.

Townes (1951) argued that the first employment of *Calicurgus* by Brullé was a mention in the synonymy of *Pompilus* Fabricius, that Brullé's name was thus unavailable and did not invalidate the subsequent proposal of *Calicurgus* by Lepeletier. Unfortunately I cannot agree with this interpretation; under a discussion of the species *P. annulatus* F., Brullé gives characters which define a group of species which might be segregated from *Pompilus* as a discrete genus, for which he stated that Lepeletier had in manuscript the name *Calicurgus*. *P. annulatus* was the only species included by Brullé. In his discussion of *P. rufipes* L., Brullé states that 'cette espèce et la suivant (*P. inermis* Brullé), appartiennent au vrai genre *Pompilus* dans les travaux de M. Lepeletier de St. Fargeau'. Unfortunate though this prior usage may be, I believe it to be valid; in no manner does Brullé suggest that he rejects the name. Rather, it should be considered a conditional proposal. Since a suitable replacement name is available, and because the valid name of the well-known Holarctic type-species must in any case change, I have no hesitation in employing *Caliadurgus* for this genus. It is widely distributed also in the Neotropics and the Oriental and Indonesian regions.

Caliadurgus fasciatellus (Spinola) **sp. rev.**

Pompilus fasciatellus Spinola, 1808 : 37. Holotype ♀, ITALY (MIZSU, Turin) [examined].
[*Pompilus hyalinatus* (Fabricius) sensu Vander Linden, 1827 : 316. Misidentification.]
[*Calicurgus hyalinatus* (Fabricius) sensu Kloet & Hincks, 1945 : 318. Misidentification.]

A female and a male stand next to a label 'Priocnemis fasciatellus (Pompilus) m. Liguria' in the Spinola collection in Turin. Labels of two other females bear data post-dating description. The male is a *Priocnemis*, probably *P. mimula* Wesmael, and is mounted on a pin of a type different from the first female; no male was in any case described. I have labelled the first as holotype of *P. fasciatellus*.

Genus *DIPOGON* Fox

Dipogon Fox, 1897 : 241. Type-species: *Dipogon populator* Fox, 1897, by original designation and monotypy.

Recent authors have treated this generic name as though it were neuter; however, it is masculine. The nominate subgenus is predominantly of New World distribution; in Britain, a holarctic subgenus is represented.

Subgenus *DEUTERAGENIA* Šustera

Agenia Schiødte, 1837 : 321. Type-species: *Sphex variegata* Linnaeus, 1758, by subsequent designation (Westwood, 1840 : 82). [Junior homonym of *Agenia* Descourtilz, 1825.]
Deuteragenia Šustera, 1912 : 191. [Replacement name for *Agenia* Schiødte.]

Dipogon* (*Deuteragenia*) *bifasciatus (Geoffroy)

Ichneumon bifasciatus Geoffroy *in* Fourcroy, 1785 : 405. Holotype ♀, FRANCE (MNHN, Paris) [examined].
Pompilus hircanus Fabricius, 1798 : 251. Lectotype ♀, EUROPE (UZM, Copenhagen), by designation of Wahis (1974 : 340) [not examined]. **Syn. n.**
Deuteragenia intermedia (Dahlbom); Kloet & Hincks, 1945 : 318.

Van der Vecht (1960 : 4) pointed out that *Sphex bifasciata* Fabricius, 1793, was not a valid species, but a subsequent citation of *Ichneumon bifasciatus* Geoffroy, 1785. The taxon is presumed to be based on material from the environs of Paris, and van der Vecht suggested that Fabricius may have seen original material, possibly via Bosc. Van der Vecht was not able to establish the identity of the species, but stated that the name should be applied in *Dipogon*. He referred to Berland (1925 : 226), who had examined 'le type de Fabricius'. Perhaps van der Vecht was misled by the existence of a female *Dipogon* in the Fabrician collection, Copenhagen, labelled 'bifasciatus' (teste Wahis, 1974 : 337). This was not, however, the specimen referred to by Berland; he had examined a headless female specimen in the Bosc collection in Paris, and affixed a 'type' label. However, he misidentified the female as '*D. hircana*' sensu authors, whereas it is a female of the true *hircana* Fabricius, the species otherwise referred to by Berland as *D. intermedia* Dahlbom. Wolf (1964 : 13) referred to van der Vecht's work, but did not realize that the identity of the species was in doubt. Wahis (1974 : 337) summarized the position and pointed out that *D. bifasciatus*, which must have been based on one or more species of *Dipogon* common near Paris, was currently applied to a species which was rare in western Europe and only doubtfully recorded from France. He examined and identified the specimens in Copenhagen and Paris seen by Fabricius, but did not associate the Paris specimen with Geoffroy. I see every advantage in interpreting this specimen from the Bosc collection as holotype of *Ichneumon bifasciatus* Geoffroy, and the name is here employed in conformity with the identity of this specimen. '*D. bifasciatum*' sensu authors appears to be an undescribed species and is treated further below.

Dipogon* (*Deuteragenia*) *nitidus (Haupt)

Deuteragenia nitida Haupt, 1927 : 138. Lectotype ♀, AUSTRIA (MLU, Halle), by designation of Wolf (1964 : 14) [examined].
[*Deuteragenia hircana* (Fabricius) sensu Kloet & Hincks, 1945 : 318. Misidentification.]

Wolf (1964) is ambiguous in his treatment of the type-material of this species, based by Haupt on a female and male from Vienna collected by Fahringer. Wolf refers to a '♀ Holotypus' and '♂ Allotypus'. It seems convenient to regard this reference as a valid type-restriction.

Dipogon (Deuteragenia) variegatus (Linnaeus)

Sphex variegata Linnaeus, 1758 : 570. Lectotype ♀, SWEDEN (CLS, London), by designation of Day (in press).
Deuteragenia variegata (Linnaeus); Kloet & Hincks, 1945 : 318.

I have elsewhere designated a lectotype for this taxon, in order to maintain existing usage.

***Dipogon (Deuteragenia) vechti* sp. n.**

[*Agenia bifasciata* ('Fabricius') sensu Dahlbom, 1843 : 80. Misidentification.]
[*Pogonius bifasciatus* ('Fabricius') sensu Dahlbom, 1845 : 454. Misidentification.]
[*Deuteragenia bifasciata* ('Fabricius') sensu Haupt, 1927 : 135. Misidentification.]
[*Dipogon* (*Deuteragenia*) *bifasciatum* (Geoffroy) sensu Wolf, 1964 : 12. Misidentification.]
[*Dipogon* (*Deuteragenia*) *bifasciatum* (Geoffroy) sensu Wahis, 1974 : 337. Misidentification.]

Many other authors have referred to this species as *D. bifasciatus*. Only the most important references have been cited. Good figures, or descriptions, or keys, can be found in each of the above works; the figures numbered 6 and 15 in Wolf (1964), of the wing venation and patterning, and the male terminalia, are diagnostic. Van der Vecht (1964 : 4) first indicated that there was confusion about the identity of *D. bifasciatus* (see discussion under that species). Dahlbom appears to have been first to misapply the name, and has subsequently always been followed.

It seems not to have been appreciated that *D. vechti* is most closely related to the Nearctic *D. sayi* Banks, and possibly also to *D. nipponica* Yasumatsu. It is not a British insect and is not common in continental western Europe.

MATERIAL EXAMINED

Holotype ♀, **U.S.S.R.**: Siberia, Amur (*Higgins*) (BMNH).

Paratypes. **U.S.S.R.**: 1 ♀, same data as holotype (BMNH). **Germany (East):** 1 ♂, Saaletal, Schönburg (*Blüthgen*) (colln R. Wahis).

Tribe AGENIELLINI Banks

Ageniellini Banks, 1912 : 222. Type-genus: *Ageniella* Banks, 1912 : 222.
Macromerinae Haupt, 1927 : 23. Type-genus: *Macromeris* Lepeletier, 1831 : 29.
Pseudageninae Banks, 1934 : 31. Type-genus: *Pseudagenia* Kohl, 1884 : 38.
Auplopodini Pate, 1946 : 117. Type-genus: *Auplopus* Spinola, 1841 : 108.

Genus *AUPLOPUS* Spinola

Auplopus Spinola, 1841 : 108. Type-species: *Pompilus femoratus* Fabricius, 1804, by monotypy.
Pseudagenia Kohl, 1884 : 38, 42. Type-species: *Sphex carbonaria* Scopoli, 1763, by original designation. [Synonymy with *Auplopus* by Pate, 1946 : 116.]

Auplopus femoratus (Fabricius)

Pompilus femoratus Fabricius, 1804 : 190. LECTOTYPE ♀, SOUTH AMERICA 'America Meridionali' (UZM, Copenhagen), here designated [examined].

The type-material consists of three females, two in Copenhagen and one in Kiel (currently also housed in Copenhagen). One bears a hand-written label (probably Fabricius's) 'P. femoratus Am. mer. Schmidt', a red label printed 'type', a label in Dahlbom's handwriting 'Agenia femoratus Dahlbom H.E. 455 8 ♀' and a label written by van der Vecht. The second Copenhagen specimen bears a red 'type' label; the third bears a label 'femorata'. I have labelled and here designate as lectotype the first female referred to above.

I have examined the material in the Spinola collection (MIZSU, Turin) on which Spinola based *Auplopus*. Six females, two of which stand over a hand-written label 'Agenia femorata var. Cayenne', appear to be conspecific with the type-material of *P. femoratus* Fabricius. I have no doubt that the name *Auplopus* is currently correctly applied as a valid name for this group, which contains one British species.

Auplopus carbonarius (Scopoli)

Sphex carbonaria Scopoli, 1763 : 294. Type-material lost, YUGOSLAVIA.
Pseudagenia carbonaria (Scopoli); Kloet & Hinks, 1945 : 318.

Subfamily **POMPILINAE** Latreille

Pompilii Latreille, 1805 : 277. Type-genus: *Pompilus* Fabricius, 1798 : 212.

Genus ***POMPILUS*** Fabricius

Pompilus Fabricius, 1798 : 212. Type-species: *Pompilus pulcher* Fabricius, 1798 [= *Sphex cinerea* Fabricius, 1775], by subsequent designation (I.C.Z.N. Opinion 166, 1945).

Pompilus cinereus (Fabricius)

Sphex cinerea Fabricius, 1775 : 350. Holotype ♀, AUSTRALIA (BMNH) [examined].
Sphex plumbea Fabricius, 1787 : 278. Holotype ♀, SPAIN (UZM, Copenhagen) [examined]. [Synonymy by Evans, 1972 : 11.]
Pompilus pulcher Fabricius, 1798 : 249. Type-material not located, presumed lost, ITALY. [Synonymy by Evans, 1972 : 11.]
Pompilus pulcher Fabricius; Coquebert, 1801 : pl. 12, figs 8a, 8b. [Good figures, believed to be of primary type-material of *P. pulcher* Fabricius.]
Pompilus plumbeus (Fabricius); Kloet & Hincks, 1945 : 318.

It is unfortunate that the type-material of the species selected by the International Commission on Zoological Nomenclature to be type-species of *Pompilus* and thus of Pompilidae is lost.

Modern interpretations of the genera of Pompilidae restrict *Pompilus* to a small group of species, of which only one is British. Other British species previously placed in *Pompilus* are distributed among other genera.

Genus ***AGENIOIDEUS*** Ashmead

Agenioideus Ashmead, 1902 : 85. Type-species: *Pompilus humilis* Cresson, 1867, by original designation.

The nominate subgenus is not yet known from the British Isles, but is represented on the Channel Islands by *A. sericeus* (Vander Linden). The sole British species is currently placed in another subgenus.

Subgenus ***GYMNOCHARES*** Banks

Gymnochares Banks, 1917 : 107. Type-species: *Psammochares birkmanni* Banks, 1910, by subsequent designation (Pate, 1946 : 88).

Agenioideus (Gymnochares) cinctellus (Spinola)

Pompilus cinctellus Spinola, 1808 : 39. LECTOTYPE ♀, ITALY (MIZSU, Turin), here designated [examined].
Pompilus cinctellus Spinola, Kloet & Hincks, 1945 : 318.

Two females stand against a label 'Pompilus cinctellus m. Ins. Lig. Liguriae' in the Spinola collection at Turin. A third female is from Scandinavia and post-dates description. I have labelled and here designate as lectotype the better preserved of the first two specimens, which conforms to the current interpretation of this species.

Agenioideus (Gymnochares) apicalis (Vander Linden)

Pompilus apicalis Vander Linden, 1827 : 312. Holotype ♀, FRANCE (IRSNB, Brussels) [teste Wahis, 1955 : 11].
Pompilus acuminatus Smith, 1851 : 119. Holotype ♂, EUROPE, provenance erroneously ? reported as Scotland (UM, Oxford) [examined]. [Synonymy by Day, 1972 : 70.]
[*Pompilus sericeus* Vander Linden sensu Kloet & Hincks, 1945 : 318, Misidentification.]

I have given reasons (Day, 1972) for believing that the type-material on which this taxon was based was of European origin. Saunders (1896 : 58) placed *P. acuminatus* in the synonymy of *P. sericeus* and recorded the latter species as a British insect. However, *P. acuminatus* is correctly a synonym of *A. apicalis* Vander Linden; I have declined to include this name in the list of British species since the two known specimens are of doubtful provenance.

Agenioideus sericeus (Vander Linden) occurs in the Channel Islands.

Genus *ARACHNOSPILA* Kincaid

Arachnospila Kincaid, 1900 : 509. Type-species: *Arachnospila septentrionalis* Kincaid, 1900 [=*Pompilus fumipennis* Zetterstedt, 1838], by monotypy.

Subgenus *ARACHNOSPILA* Kincaid

Arachnospila Kincaid, 1900 : 509.

Arachnospila* (*Arachnospila*) *rufa (Haupt)

[*Pompilus fumipennis* Zetterstedt sensu Dahlbom, 1843 : 76. Misidentification.]
Psammochares (*Psammochares*) *rufus* Haupt, 1927 : 197. LECTOTYPE ♂, GERMANY (EAST) (MLU, Halle), here designated [examined].
Pompilus rufus (Haupt); Kloet & Hincks, 1945 : 318.

Haupt proposed *P. rufus* as a 'nom. nov.' for the species misidentified by Dahlbom as *P. fumipennis*; it was of course a description of a new species rather than a new name. He designated no primary type. I have seen material from Haupt's collection; I have labelled and here designate as lectotype a male which bears Haupt's determination label and collection data predating description. It was collected at Gräfenhainichen, 21.v.1925, possibly by Haupt himself. This specimen conforms to current usage.

Subgenus *ANOPLOCHARES* Banks

Anoplochares Banks, 1939 : 225. Type-species: *Pompiloides rectus* Banks, 1914 [=*Pompilus apicatus* Provancher, 1882], by original designation.

Arachnospila* (*Anoplochares*) *minutula (Dahlbom)

Pompilus minutus Dahlbom, 1829 : 3. Type-material not located, presumed lost, SWEDEN. [Junior primary homonym of *P. minutus* Vander Linden, 1827.]
Pompilus minutulus Dahlbom, 1842 : 10. [Replacement name for *P. minutus* Dahlbom.]
Pompilus minutulus Dahlbom; Kloet & Hincks, 1945 : 318.

Arachnospila* (*Anoplochares*) *spissa (Schiødte)

Pompilus spissus Schiødte, 1837 : 336. Type-material not located, presumed lost, DENMARK.
Pompilus spissus Schiødte; Kloet & Hincks, 1945 : 318.

Specimens in Schiødte's collection (UZM, Copenhagen) agree with current interpretation, but are thought by Drs Petersen and Lomholdt to post-date description.

Subgenus *AMMOSPHEX* Wilcke

Ammosphex Wilcke, 1942 : 25. Type-species: *Pompilus unguicularis* Thomson, 1870 [=*Pompilus anceps* Wesmael, 1851], by original designation.
Anopompilinus Dreisbach, 1949 : 7. Type-species: *Anopompilinus michiganensis* Dreisbach, 1949, by monotypy. [Synonymy by Evans (1951 : 227).]
Boreopompilus Wolf, 1965 : 88, 101 (as subgenus of *Pompilus*). Type-species: *Pompilus trivialis* Dahlbom, 1843, by original designation. **Syn. n.**

Other subgeneric names of uncertain value are currently employed for non-British species, but are not considered further here. *Anopompilinus* has as type-species a species placed in *Boreopompilus* by Wolf.

Arachnospila* (*Ammosphex*) *anceps (Wesmael)

[*Sphex gibba* Linnaeus sensu Fabricius, 1775 : 350. Misidentification.]

? *Sphex vagus* Harris, 1780 : 95. Type-material not located, presumed lost, Great Britain. [Junior primary homonym of *Sphex vaga* Linnaeus, 1758 [= *Mellinus arvensis* Linnaeus, 1758 (Sphecidae)].]

[*Pompilus gibbus* (Linnaeus) sensu Fabricius, 1798 : 249. Misidentification.]

[*Pompilus trivialis* Dahlbom, 1843 : 65. Mixed series, see notes under *A. trivialis*. Misidentification.]

Pompilus anceps Wesmael, 1851 : 463, ♀. Lectotype ♀, Belgium (IRSNB, Brussels), by designation of Wahis (1957 : 5) [not examined].

[*Pompilus abnormis* Dahlbom sensu Wesmael, 1851 : 464; ♂. Misidentification.]

Pompilus unguicularis Thomson, 1870 : 221; ♀. LECTOTYPE ♀, Sweden (ZI, Lund), here designated [examined]. [Synonymy by Wahis (1957 : 5).]

[*Pompilus trivialis* Dahlbom sensu Thomson, 1870 : 221; ♂. Misassociation of sexes. Misidentification.]

Pompilus unguicularis Thomson; Saunders, 1896 : 56, 64; ♀.

[*Pompilus gibbus* (Linnaeus) sensu Fabricius; Saunders, 1896 : 56, 64; ♂. Misidentication.]

Psammochares (*Psammochares*) *unguicularis* (Thomson); Haupt, 1927 : 155, 201; ♀.

[*Psammochares* (*Psammochares*) *gibbus* (Linnaeus) sensu Fabricius; Haupt, 1927 : 164, 204; ♂. Misidentification.]

[*Pompilus trivialis* Dahlbom sensu Spooner, 1941 : 85; ♀, ♂. Misidentification.]

Ammosphex unguicularis (Thomson); Wilke, 1942 : 27; ♀, ♂.

[*Pompilus trivialis* Dahlbom sensu Kloet & Hincks, 1945 : 318. Misidentification.]

Pompilus anceps Wesmael; Wahis, 1957 : 5.

Arachnospila (*Ammosphex*) *anceps* (Wesmael); Priesner, 1966 : 190.

P. unguicularis Thomson. Wesmael's *P. anceps* was misidentified by Thomson (see below) who listed the species as a synonym of *P. trivialis*. He proposed *P. wesmaeli* for the species that he believed Wesmael had misidentified as *P. trivialis*. However, Wesmael had not done so (see synonymy and lectotype designation for *P. trivialis* and *P. wesmaeli* below). Thomson proposed *P. unguicularis* for a species which he believed Wesmael had failed to discriminate, in reality *P. anceps*.

Four females in the collections at Lund under the name *unguicularis*, one so labelled by Thomson, are all specimens of the species currently known as *A. anceps*. A male is a specimen of *A. trivialis*. I have labelled and here designate as lectotype the female bearing Thomson's label.

Sphex vagus Harris was probably a composite of several species of Pompilinae.

Arachnospila* (*Ammosphex*) *consobrina (Dahlbom)

Pompilus ater Brullé, 1840 : 91. Holotype ♂, Canary Islands (MNHN, Paris) [examined]. [Junior primary homonym of *P. ater* Dahlbom, 1829.]

Pompilus consobrinus Dahlbom, 1843 : 79. Lectotype ♂, Sweden (UZI, Lund), by designation of Blüthgen (1952*b* : 11) [examined].

Pompilus consobrinus Dahlbom; Kloet & Hincks, 1945 : 318.

P. ater Brullé. A headless male type-specimen survives in Paris.

Arachnospila* (*Ammosphex*) *trivialis (Dahlbom)

[*Sphex gibba* Linnaeus sensu Fabricius, 1775 : 350. Misidentification.]

[*Pompilus gibbus* (Linnaeus) sensu Fabricius, 1798 : 249. Misidentification.]

Pompilus trivialis Dahlbom, 1843 : 65. LECTOTYPE ♀, Sweden (UZI, Lund), here designated [examined].

Pompilus trivialis Dahlbom; Wesmael, 1851 : 462.

Pompilus trivialis Dahlbom; Thomson, 1870 : 220; ♀.

[*Pompilus unguicularis* Thomson, 1870 : 221; ♂. Misassociation of sexes. Misidentification.]

[*Pompilus gibbus* (Linnaeus) sensu Fabricius; Saunders, 1896 : 57, 63; ♀. Misidentification.]

[*Pompilus unguicularis* Thomson sensu Saunders, 1896 : 56, 64; ♂. Misidentification.]

[*Psammochares* (*Psammochares*) *gibbus* (Linnaeus) sensu Fabricius; Haupt, 1927 : 156, 204; ♀. Misidentification.]

[*Psammochares* (*Psammochares*) *unguicularis* (Thomson) sensu Haupt, 1927 : 155, 201; ♂. Misidentification.]

[*Pompilus unguicularis* Thomson sensu Spooner, 1941 : 85; ♀, ♂. Misidentification.]

[*Ammosphex gibba* (Linnaeus) sensu Fabricius; Wilke, 1942 : 28; ♀, ♂. Misidentification.]

Ammosphex trivialis (Dahlbom); Wilke, 1943 : 56; ♀, ♂.
[*Pompilus unguicularis* Thomson sensu Kloet & Hincks, 1945 : 318. Misidentification.]

P. trivialis Dahlbom. Early authors were familiar with a common red and black pompilid which was invariably misidentified as *Sphex gibba* (or *Pompilus gibbus*) Fabricius. This name is in fact a Linnaean name and applies to a bee, *Sphecodes gibbus* (Linnaeus); the 'pompilid' was a composite of several species. Dahlbom recognized that no name was available for this 'species' and thus described *P. trivialis*. However, he described it from a mixed series of two of the species which had probably always been confused under *Sphex gibba* by previous authors. Probably syntypic material in the collections at Lund consists of two females and a male of one species and two females of another.

Wesmael (1851 : 463) recognized the problem and segregated the females of this complex. However, he identified the male of one as *P. abnormis* Dahlbom, but probably associated correctly the sexes of the other. He records that a specimen sent to him as *P. trivialis* by Dahlbom was in fact *P. chalybeatus* Dahlbom (= *Anoplius infuscatus* (Vander Linden)). He applied the name *P. trivialis* to one component of the complex (that for which he associated both sexes), and described the other as *P. anceps*. Wahis fixed the identity of *P. anceps* when he discovered type-material and designated a lectotype.

The two females and the male of the first species mentioned as in the Lund collection are specimens of *P. anceps*. I have therefore labelled and here designate as lectotype of *P. trivialis* one of the two females of the second species. This both fixes the identity in accord with current interpretation and agrees with the conclusions of Wesmael, who was the first reviser.

Arachnospila* (*Ammosphex*) *wesmaeli (Thomson)

Pompilus wesmaeli Thomson, 1870 : 221. LECTOTYPE ♂, SWEDEN (UZI, Lund), here designated [examined].
Pompilus wesmaeli Thomson; Kloet & Hincks, 1945 : 318.

A mixed series of specimens from the collections at Lund which stand under the label 'wesmaeli Thomson' consists of females of *A. anceps*, *Evagetes pectinipes* and one female possibly of *A. wesmaeli*. One female of *A. anceps* bears a Thomson label 'wesmaeli'. A single male specimen, pinned below the female *E. pectinipes*, agrees well with Thomson's description of the male. I have labelled and here designate as lectotype this male specimen.

Thomson proposed *P. wesmaeli* for the species he believed Wesmael had misidentified as *P. trivialis* Dahlbom.

Genus ***EVAGETES*** Lepeletier

Evagetes Lepeletier, 1845 : 390. Type-species: *Evagetes bicolor* Lepeletier, 1845 [= *Aporus dubius* Vander Linden, 1827], by monotypy.
Psammocharoides Móczár, 1946 : 114. Type-species: *Pompilus crassicornis* Shuckard, 1837, by original designation. [Synonymy with *Sophropompilus* Ashmead by Móczár, 1956 : 8.]
Streptosella Dreisbach, 1950 : 570. Type-species: *Streptosella steyskali* Dreisbach, 1950 [= *Pompilus crassicornis* Shuckard, 1837], by subsequent designation (Evans, 1951 : 310). [Synonymy by Evans (1951 : 310).]
Carinevagetes Wolf, 1970 : 52. Type-species: *Pompilus crassicornis* Shuckard, 1837, by original designation. **Syn. n.**

Other names are also currently regarded as synonyms of *Evagetes*, but only those based on type-species that occur in Britain are here listed. Some others are currently employed as subgeneric names for very limited groups of species. Assessment of the value of these must await more detailed treatment.

Evagetes crassicornis (Shuckard)

Pompilus crassicornis Shuckard, 1837 : 63. Type-material not located, presumed lost, GREAT BRITAIN.

Pompilus crassicornis Schiødte, 1837 : 335. Type-material not located, presumed lost, DENMARK. [Junior primary homonym of *Pompilus crassicornis* Shuckard, 1837.]
Pompilus crassicornis Shuckard; Kloet & Hincks, 1945 : 318.

The dates of publication of the works in which Shuckard's and Schiødte's species were described are discussed under *Priocnemis agilis*.

E. crassicornis has frequently been misidentified in Britain as *E. pectinipes* Linnaeus.

Evagetes dubius (Vander Linden)

[*Aporus bicolor* Spinola, 1808 : 34; ♀, partim. Misidentification.]
Aporus ? *dubius* Vander Linden, 1827 : 351. Type-material not located, presumed lost, BELGIUM.
Evagetes bicolor Lepeletier, 1845 : 390. LECTOTYPE ♂, FRANCE (MNHN, Paris), here designated [examined]. [Synonymy implied by Lepeletier, 1845 : 390.]
Evagetes dubius (Vander Linden); Kloet & Hincks, 1945 : 318.

A. dubius. A female in the collection of the IRSNB, Brussels, has been considered by Richards (1935 : 161) and Wahis (1955 : 9) to be the probable type of *A. dubius*. However, Vander Linden clearly refers to specimens of both sexes and states 'mon cabinet'. The female here considered is mounted in a manner and bears labels exactly similar to those borne by three specimens of *A. femoralis* Vander Linden which are here excluded from type-status on other criteria (see *Aporus unicolor*). These specimens (*A. dubius* and *A. femoralis*) were probably collected by Wesmael and post-date description. However, the question is academic, since the putative type-specimens of both species agree with current interpretation.

E. bicolor Lepeletier. Two female and three male specimens, conspecific, stand under this name in Lepeletier's collection. I have labelled and here designate as lectotype the male which agrees best with the original figure.

Evagetes pectinipes (Linnaeus)

Sphex pectinipes Linnaeus, 1758 : 570. Holotype ♀, SWEDEN (CLS, London) [examined].

Mr K. Guichard took a male on dunes at Deal in Kent during 1966. Mr Guichard and Mr G. Else took a series of both sexes at the same locality on various dates during 1975: the species appears to be well established. It is a new addition to the British list.

The name *P. pectinipes* (L.) has often appeared in lists of British species as a misidentification of *P. crassicornis* Shuckard.

Genus *ANOPLIUS* Dufour

Psammochares Latreille, 1796 : 115. Type-species: *Sphex fusca* Linnaeus, 1761, by subsequent designation (Latreille, 1803 : 158). [Suppressed by I.C.Z.N. Opinion 166, 1945.]
Anoplius Dufour, 1834 : 483. Type-species: *Sphex nigerrima* Scopoli, 1763, by subsequent designation (Van der Vecht & Menke, 1968 : 120); ratified by I.C.Z.N. Opinion 997, 1973.

Subgenus *ANOPLIUS* Dufour

Anoplius Dufour, 1834 : 483.

Anoplius* (*Anoplius*) *caviventris (Aurivillius)

Pompilus caviventris Aurivillius, 1907 : 10. Holotype ♂, SWEDEN (NR, Stockholm) [examined].
Pompilus cardui Perkins, 1917 : 10. LECTOTYPE ♂, GREAT BRITAIN (BMNH), here designated [examined]. [Synonymy by Chambers (1948 : 232).]
[*Anoplius piliventris* (Morawitz) sensu Kloet & Hincks, 1945 : 318. Misidentification.]

Perkins described from a male collected in the Forest of Dean (now in the Cambridge Museum, U.K.) and a male and female bred from the stems of thistles at Stanmore, Middlesex (now in BMNH). I have labelled and here designate as lectotype, the male from Stanmore.

I have examined the holotype of *Pompilus piliventris* Morawitz. It is a male of the species currently known as *Anoplius pannonicus* Wolf, 1965. This synonymy is formalized below, although the species is not yet recorded from Britain.

Anoplius* (*Anoplius*) *piliventris (Morawitz) **sp. rev.**

Pompilus piliventris Morawitz, 1889 : 122. Holotype ♂, CHINA (ZI, Leningrad) [examined].
Anoplius pannonicus Wolf, 1965 : 94. Holotype ♂, HUNGARY (TM, Budapest) [not examined]. **Syn. n.**

Recent continental authors have placed this name as a synonym of *Anoplius tenuicornis* (Tournier, 1889), over which the name *piliventris* would have had priority were the synonymy correct!

Anoplius* (*Anoplius*) *concinnus (Dahlbom)

Pompilus concinnus Dahlbom, 1845 : 444. Type-material not located, presumed lost, FINLAND, GERMANY.
Pompilus approximatus Smith, 1877 : 64. LECTOTYPE ♀, SCOTLAND (UM, Oxford), here designated [examined]. [Synonymy by Haupt (1927 : 243).]
Anoplius concinnus (Dahlbom); Kloet & Hincks, 1945 : 318.

P. approximatus Smith. Two females in the collections of UM, Oxford standing over the name 'approximatus' bear data compatible with that given by Smith. The larger specimen bears a label 'Thornhill Dumfries Sept. 30th. Mr Sharp', the smaller simply 'Dumfries Sept, 1874'. The specimens are conspecific and clearly identifiable as *A. concinnus*. I have labelled and here designate as lectotype the larger specimen.

Anoplius* (*Anoplius*) *nigerrimus (Scopoli)

Sphex nigerrima Scopoli, 1763 : 295. Neotype ♀, SWITZERLAND (RNH, Leiden), designated by Van der Vecht & Menke (1968 : 123) [examined].
Anoplius nigerrimus (Scopoli); Kloet & Hincks, 1945 : 318.

Subgenus *ARACHNOPHROCTONUS* Howard

Psammochares Latreille, 1796 : 115. Type-species: *Sphex fusca* Linnaeus, 1761, by subsequent designation (Latreille, 1803 : 158). [Suppressed by I.C.Z.N. Opinion 166, 1945.]
Arachnophroctonus Howard, 1901 : pl. 17, figs 11, 14. Type-species: *Sphex tropica* Linnaeus sensu Fabricius, 1775 (misidentification) [=*Pompilus semicinctus* Dahlbom, 1843], by subsequent designation (Pate, 1946 : 129).

Anoplius* (*Arachnophroctonus*) *infuscatus (Vander Linden)

Pompilus infuscatus Vander Linden, 1827 : 339. Type-material not located, presumed lost, ITALY.
Pompilus minor Herrich-Schaeffer, 1830 : 117, pl. 19. Type-material not located, presumed lost, GERMANY. [Senior primary homonym of *P. minor* Zetterstedt, 1838.] **Syn. n.**
Pompilus sericatus Shuckard, 1837 : 60. Holotype ♂, GREAT BRITAIN (UM, Oxford) [examined]. [Synonymy by Saunders, 1880 : 236.]
Anoplius infuscatus (Vander Linden); Kloet & Hincks, 1945 : 318.

The male of *A. infuscatus* is readily recognized by the noticeable emargination of the apparent fourth and the very strong emargination of the fifth sterna, but Vander Linden states fifth and sixth. However, were the sixth abdominal segment telescoped within the fifth, this discrepancy would easily be explained. It is most unlikely that this description applies to other than this very common pompilid, which is widely distributed in the western Palaearctic Region.

P. minor Herrich-Schaeffer was clearly described from a mixed series of material containing *A. infuscatus* and probably various species of *Arachnospila* (*Ammosphex*). The figure is of little value, but is certainly not of *A. infuscatus*. In order to protect various current names, I choose to sink *P. minor* in the synonymy of *A. infuscatus*. Unfortunately, *P. minor* is a senior primary homonym of *P. minor* Zetterstedt, 1838, a name currently employed for a European species of *Priocnemis*; no new name is here proposed.

P. sericatus Shuckard is represented in the Hope department collections in Oxford by a single male which bears a label in Smith's handwriting 'Type- from Shuckard's collection- P. sericatus' (see Smith, 1858 : 65).

Anoplius **(*Arachnophroctonus*)** ***viaticus*** (Linnaeus)

Sphex viatica Linnaeus, 1758 : 570. Lectotype figure, *in* Frisch, 1721 : pl. 1, fig. 13, GERMANY by designation of van der Vecht (1958 : 47) [examined].

Sphex fusca Linnaeus, 1761 : 412. Lectotype ♀, SWEDEN (CLS, London), by designation of Day (in press).

Anoplius fuscus (Linnaeus); Kloet & Hincks, 1945 : 318.

I believe the nomenclatural history of this name to be so involved that it will bear repetition of an account given elsewhere (Day, in press).

Linnaeus's *Sphex viatica* of 1758 was clearly a loose concept based on mixed observation of a common pompilid wasp currently known as *Anoplius viaticus* (L.), and the sphecid wasp currently known as *Podalonia hirsuta* (Scopoli), and possibly of other taxa. In 1761, Linnaeus differentiated between the pompilid and the sphecid by describing as new *Sphex fusca*. He added the word 'pubescens' to his earlier diagnosis of *S. viatica*, but did not eliminate inappropriate references formerly given with *viatica* which more properly related to *S. fusca*. Further, the statement 'cingulis nigris' was not transferred from the diagnosis of *S. viatica* to that of *S. fusca*, to which species it positively applies. A dichotomy of usage thus developed, with Fabricius and others using *S. viatica* for the pompilid currently so called, and applying *S. fusca* to the group of species including *Priocnemis perturbator* (Harris). In contrast, De Geer (1771) and others used *S. viatica* for the sphecid and *S. fusca* for the pompilid called *viatica* by Fabricius.

Latreille (1805 : 293; 1809 : 55) called attention to this dichotomy and referred to the pompilid in his various papers either as '*Pompilus viaticus* Fabricius' or as *Sphex fusca* Linnaeus. He clearly stated that *Sphex viatica* L. was the sphecid otherwise known as *Sphex arenaria* Fabricius (=*Podalonia hirsuta* (Scopoli)).

Shuckard (1837 : 62) examined the Linnaean collection and found a single female specimen labelled 'viatica', which proved to be the sphecid. However, he rejected the specimen as type, and retained the name for the pompilid; 'for the cabinet, from a variety of accidents, is not always to be depended upon'. Dahlbom (1843 : 18, 57) used the name both for the sphecid and the pompilid. Smith (1858 : 54, 82) applied the name *viatica* to the sphecid and *fusca* to the pompilid after examination of the Linnaean collection. He also proposed a name, *Pompilus sepicola*, for the entity misidentified by Fabricius as *S. fusca*. Latreille had clearly stated the problem, but Smith was perhaps the first worker to make comprehensive proposals of action to stabilize the application of these names.

Kohl (1906 : 279), in a major re-appraisal of the group of sphecids to which *Podalonia hirsuta* belongs, rejected the use of *S. viatica*. Haupt (1927 : 308), in a work of similar scope dealing with the Palaearctic Pompilidae, rejected the name from use in the Pompilidae. Richards (1935 : 165) re-examined the Linnaean specimen and opted to apply the name in the Sphecidae. It is unfortunate that he was not followed by continental authors: his conclusions were made in the context of a work resolving nomenclatural problems in the Aculeata as a whole. Thus his view was not clouded by a particular viewpoint consequent upon the convenience of the nomenclature of any one restricted group within the aculeates. However, Verhoeff (1947 : 334) reversed the application. Finally, van der Vecht (1958 : 47) took action that he felt should be conclusive. Reasoning that no valid type-restriction had been made, he designated as lectotype a figure originally cited by Linnaeus, which is purported to be of a pompilid. However, Townes (1973) has disputed the validity of this procedure on several grounds, principally of the validity and priority of various past possible type-restrictions. Currently, the matter is subject of a submission to the International Commission on Zoological Nomenclature, concerned primarily with certain points of taxonomic procedure (Sabrosky, 1974). However, as a secondary consequence, the Commission will determine the validity or otherwise of past type-fixations. Provisionally, the name *Sphex viatica* Linnaeus is here applied in conformity with current usage.

Genus ***EPISYRON*** Schiødte

Episyron Schiødte, 1837 : 341. Type-species: *Sphex rufipes* Linnaeus, 1758, by monotypy.

Episyron rufipes (Linnaeus)

Sphex rufipes Linnaeus, 1758 : 571. Lectotype ♀, SWEDEN (CLS, London), by designation of Day (in press).
Episyron rufipes (Linnaeus); Kloet & Hincks, 1945 : 318.

Genus *APORUS* Spinola

Aporus Spinola, 1808 : 5. Type-species: *Aporus bicolor* Spinola, 1808, by subsequent designation (Latreille, 1810 : 437).

Spinola proposed *Aporus* as a new genus which included two new species, *A. unicolor*, supposedly known only from males, and *A. bicolor*, known only from females. He suggested that these might be opposite sexes of a single species. The genus was characterized chiefly by the possession of two submarginal cells in the forewing, in contrast to the more usual three in *Pompilus* s. l. However, more than a page of further diagnosis was given. It is clear from the literature and from examination of Spinola's own collection that material of more than one currently recognized genus was confused by him; indeed, it is probable that the only characters routinely examined were those of the wing venation and abdominal coloration, despite the more detailed original diagnosis given. Since Spinola described *Aporus*, authors have interpreted the genus in several different ways; none has studied type-material.

Latreille (1809) disputed the value of Spinola's genus, but with reservations; he placed Spinola's species in a subgroup of *Pompilus* s. l. He also described *Pompilus planiceps*, a related species, in a different subgroup. In 1810, he recognized *Aporus* and designated *A. bicolor* as type-species. Leach (1815) based a subfamily Aphorida (sic) on *Aporus*. Latreille (1825) established the genus *Planiceps* for *P. planiceps*. Vander Linden (1827) identified Belgian material as *A. unicolor* and *A. bicolor*, and described as new *Aporus femoralis*, based on Belgian males, and *Aporus ? dubius*, based on females. The latter he clearly placed apart from the first three species, as indicated both by his question mark and his discussion. He also placed *P. planiceps* in a separate genus, as *Planiceps latreillei* Vander Linden. Klug (1834) described several species from Egypt, all lacking the third submarginal cell, but otherwise of diverse affinities. Lepeletier (1845) included in *Aporus* the three species dealt with by Vander Linden. He also described a new genus and species, *Evagetes bicolor*, and clearly indicated that he believed this to be the same species as *Aporus ? dubius* Vander Linden.

Dahlbom (1845) treated *Aporus* as a genus, placed immediately after *Planiceps* in his key. He included 11 species; those of Spinola, Vander Linden and Klug, species of diverse affinities but with two submarginal cells as their common characteristic. Wesmael (1851) realized that Vander Linden's material of *Aporus* consisted of a single species and that *A. ? dubius* was a member of a discrete genus. Smith (1855) reversed the trend and added yet more species to *Aporus* s. l. such that the group contained representatives of yet more modern genera. Kohl (1884) distributed the species amongst various of his 'Gruppe' of *Pompilus*, and indicated that he regarded each component group of species with two submarginal cells as closely related to one or other of his groups with three submarginal cells rather than to other groups with two cells. He recognized *Planiceps* as a discrete genus, but did not discuss the identity of *Aporus*. Tournier (1889) described several new species in *Aporus*.

Šustera (1913) discussed Kohl's treatment, but, whilst recognizing the artificiality of separating closely related species into different genera defined by the number of submarginal cells, nevertheless opted to do so. However, he cited as type-species of *Aporus*, *A. unicolor* Spinola (following Ashmead, 1802) and stated that it is closely related to a group of species including *P. trivialis* Dahlbom. He thus probably had before him a species of the modern genus *Tachyagetes* Haupt. In 1927, Haupt listed *Planiceps* as a junior synonym of *Aporus*, and recognized only two species: *A. unicolor* (which, following Šustera and Ashmead in nomenclature but not in identity, he took to be type-species) and *A. pollux* (Kohl). He cited *A. bicolor*, *P. planiceps*, *A. femoralis* and other species in the synonymy of *A. unicolor*. He placed *A. dubius*, with *Evagetes filicornis* Tournier, 1889, in a subgenus *Evagetes* of *Psammochares* (=*Pompilus*).

In 1930, Haupt published a revision of *Aporus*. In preparing the work, he studied two specimens in the collections of MNHU, Berlin, which appear to have been sent to Klug by Spinola, and which may be syntypic material. One specimen was labelled *A. unicolor*, the other *bicolor*. Haupt based his interpretation of *Aporus* on the supposed male of *A. unicolor*, and recognized six Palaearctic species. He placed *P. planiceps* in a monotypic subgenus *Planiceps*. The specimen labelled *A. bicolor* proved to be a male of *Evagetes filicornis* Tournier, which Haupt in the same work designated type-species of a new genus, *Tachyagetes*. He reserved judgement on the possible identity of further type-material in the Spinola collection and suggested only in his discussion of *Aporus* that *A. bicolor* might be a senior synonym of *Evagetes filicornis*; the matter was ignored under his treatment of *Tachyagetes*. However, since he regarded *A. unicolor* as type-species of *Aporus*, the problem of synonymy of generic names did not occur to him.

Pate (1946), in an exhaustive catalogue of pompilid genera, reviewed the problem in the light of his own bibliographic researches. He found that Latreille had validly designated *A. bicolor* as type-species of *Aporus* in his work of 1810 (expressly validated by I.C.Z.N. Opinion 11). This was at variance with previous interpretations, which had accepted *A. unicolor* as type-species. Further, if other type-material of *A. bicolor* should finally be shown to be identical with the putative syntype in Berlin, then the name *Aporus* would have to be transferred as a senior synonym of the genus currently known as *Tachyagetes* Haupt. Indeed, Pate recommended that such a course be followed.

Evans (1966) made a plea for continuation of usage in the sense of Haupt, and suggested application to the I.C.Z.N. for preservation of *Aporus* in its current sense in the event that examination of type-material substantiates Pate's conclusions.

It is clear from the literature that an early dichotomy developed between those authors who applied the name in the modern sense of Haupt and those who applied the name to the group first differentiated by Vander Linden and named *Evagetes* by Lepeletier. Indeed, Latreille most probably had before him material of *E. dubius* rather than *Aporus*. Later, *Aporus* was used either for a composite group including representatives of genera such as *Telostegus* and *Ctenostegus* in addition to others listed above, or else for the group of species now called *Tachyagetes*. However, Haupt (1930) and subsequent workers have applied the name consistently.

The specimens in the Spinola collection at Turin bear no labels, but stand next to labels pinned in the store boxes. Box 81 contains material under various labels, but all stand under the name 'Aporus latreillei V. Lind.' (=*Pompilus planiceps* Latreille). Spinola had corresponded and exchanged material with Latreille, and had up-dated his collection in the light of subsequent publication by other authors.

A single label, as follows; 'Aporus latreillei, ♂ . . . unicolor mihi, Ins. Lig. Evagetes Lepell. France & Ligurie' has to its right a single specimen badly damaged by *Anthrenus*; it bears a number on a small circular label, '6162'. A further label, 'G. Planiceps' is pinned to the right of the specimen. I regard this specimen as a syntype of *A. unicolor* Spinola.

Next is a label 'Aporus latreillei ♀ coll. Latr. Paris'. Above this label are three females which may well be regarded as syntypes of *Pompilus planiceps* Latreille. After other labels, a label as follows: 'Aporus latreillei var. ♀ m. . . . bicolor mihi faun. Ins. Lig. Ev. bicolor St. Farg? Ligurie'. Above this label are four specimens; I regard these as syntypes of *A. bicolor* Spinola.

Aporus bicolor Spinola

Aporus bicolor Spinola, 1808 : 34. LECTOTYPE ♀, ITALY (MIZSU, Turin), here designated [examined].

I regard as syntypes four specimens from Turin (see above) and the male of *T. filicornis* from MNHU examined by Haupt. One specimen from Turin is a female of the group of species currently assigned to *Aporus* in the sense of modern authors; it agrees best with Wolf's (1972) interpretation of *A. helveticus* Tournier and *A. fulviventris pollux* (Kohl). Two females are specimens of *Evagetes dubius* Vander Linden; the fourth specimen is a thorax with wings of a *Tachyagetes*, probably a female *T. filicornis*. The Berlin specimen is, as Haupt has stated, a male *Tachyagetes*. I have therefore labelled and here designate as lectotype the female specimen listed first from Turin. *Aporus* is thus stabilized in the sense of modern authors and *Evagetes* and *Tachyagetes* are also conserved in their current applications.

Further work is needed to elucidate the western Palaearctic species of *Aporus*; several nominal species are based on mixed series of syntypes. In my own view, a more practical assessment of variation in this group will reduce the number of European species recognized. However, the name *A. bicolor* can be applied as current valid name to the species recognized by Wolf (1972) as *A. helveticus* Tournier and *A. fulviventris pollux* (Kohl). Whether these names are properly applied, and are or are not thus synonyms of *A. bicolor*, remains to be determined.

Aporus unicolor Spinola

Aporus unicolor Spinola, 1808 : 33. LECTOTYPE ♂, ITALY (MIZSU, Turin), here designated [examined].
Aporus femoralis Vander Linden, 1827 : 349. Holotype ♂, not located, presumed lost, BELGIUM. **Syn. n.**
Pompilus (*Planiceps*) *castor* Kohl, 1838 : 150. Syntypes ♀, AUSTRIA (NM, Vienna) [examined]. **Syn. n.**
Aporus unicolor Spinola; Richards, 1935 : 161.
Aporus unicolor Spinola; Kloet & Hincks, 1945 : 318.
Aporous (sic) *femoralis* Vander Linden; Else, 1975 : 82. [Biology.]

A. unicolor. The male from Turin referred to above and the male from Berlin may be regarded as syntypes. The first, despite damage, is recognizable as a male of the species currently known as *Aporus femoralis* Vander Linden (sensu Haupt, 1930; Wolf, 1972; =*A. unicolor* of British authors). The second is a male of a different species, on which the current interpretation of *A. unicolor* is based, and which is a very small male of the species above identified as *A. bicolor* Spinola. I have labelled and here designate as lectotype the Turin specimen, which corresponds to *A. unicolor* sensu British authors.

Aporus femoralis. Vander Linden described from a single male with certain notable features: 'deuxième cubitale [cell] qui est petite et ne reçoit que la première nervure recurrente; la seconde de ces nervures s'insère un peu au-delà de cette cellule.' None of three possible specimens in the collections of IRSNB, Brussels agrees in this particular, all have the 'seconde nervure' interstitial or prefurcal, and I conclude that the holotype is lost, as are most other type-specimens of species described by Vander Linden. However, the species has always been consistently interpreted; confusion has centred on the identity of Spinola's species.

A. unicolor preys on the purse-web spider, *Atypus affinis*.

Genus *HOMONOTUS* Dahlbom

Homonotus Dahlbom, 1843 : 35. Type-species: *Sphex sanguinolenta* Fabricius, 1793, by monotypy.

Homonotus sanguinolentus (Fabricius)

Sphex sanguinolenta Fabricius, 1793 : 211. Holotype ♀, GERMANY (UZM, Copenhagen) [examined].
Pompilus dispar Latreille, 1809 : 65. Type-material not located, presumed lost, FRANCE. [Senior primary homonym of *P. dispar* Dahlbom, 1843 : 75.] **Syn. n.**
Homonotus sanguinolentus (Fabricius); Kloet & Hincks, 1945 : 318.

S. sanguinolenta Fabricius. Though damaged, the Fabrician specimen is clearly recognizable.

P. dispar Latreille. No type-material of this taxon is known: the name has lain uninvestigated since proposal. Dalla Torre (1897 : 285) placed it at the head of the synonymy of *P. dispar* Dahlbom, 1843, of which it is a senior homonym but not a synonym. I believe the interpretation here ascribed to *P. dispar* Latreille is the most probable, based on his description, and conveniently removes the name into synonymy. No new name is here proposed for *P. dispar* Dahlbom, a name sometimes applied to large females of *Anoplius infuscatus* Vander Linden.

Subfamily CEROPALINAE Radoszkowski

Ceropalidae Radoszkowski, 1888 : 489. Type-genus: *Ceropales* Latreille, 1796 : 123.

Genus *CEROPALES* Latreille

Ceropales Latreille, 1796 : 123. Type-species: *Evania maculata* Fabricius, 1775, by subsequent designation (Latreille, 1810 : 437).

Ceropales maculata (Fabricius)

Evania maculata Fabricius, 1775 : 345. LECTOTYPE ♀, GREAT BRITAIN (BMNH), here designated [examined].
Ceropales semiannulatus Curtis, 1839 : 756. Holotype ♀, GREAT BRITAIN (NMV, Melbourne) [examined]. **Syn. n.**
Ceropales maculata (Fabricius); Kloet & Hincks, 1945 : 318.

E. maculata Fabricius. One female and one male specimen in the Banks collection (BMNH) both lack the abdomen. Eight additional specimens in Copenhagen are only doubtfully syntypes. I have labelled and here designate as lectotype the female in the Banks collection, since this is the originally cited depository.

Ceropales semiannulatus. The holotype female bears a printed label 'semiannulatus', a red-edged 'type' label, and Richards's label, 'Ceropales semiannulatus Curtis ♀ type =C. maculata (Fab) OWR 10.11.48.'.

Ceropales variegata (Fabricius)

Evania variegata Fabricius, 1798 : 241. Holotype ♂, GERMANY (EAST) (UZM, Copenhagen) [examined].
Ceropales variegata (Fabricius); Kloet & Hinks, 1945 : 318.

Check list of British species

The names listed as valid in Kloet & Hincks (1945) are given in square brackets where they differ from those used in the present work.

CRYPTOCHEILUS Panzer	
Subgenus ***ADONTA*** Billberg	
notatus (Rossius)	[*affinis* (Vander Linden)]
PRIOCNEMIS Schiødte	
Subgenus ***PRIOCNEMIS*** Schiødte	
agilis (Shuckard)	[*obtusiventris* Schiødte]
cordivalvata Haupt	
exaltata (Fabricius)	
fennica Haupt	[new to list]
gracilis Haupt	
hyalinata (Fabricius)	[*femoralis* (Dahlbom)]
parvula Dahlbom	[*minor* (Zetterstedt)]
propinqua (Lepeletier)	
pusilla Schiødte	
schioedtei Haupt	
Subgenus ***UMBRIPENNIS*** Junco	
coriacea Dahlbom	
perturbator (Harris)	
susterai Haupt	[new to list]
CALIADURGUS Pate	[*Calicurgus* Lepeletier]
fasciatellus (Spinola)	[*hyalinatus* (Fabricius)]
DIPOGON Fox	[*Deuteragenia* Šustera]
Subgenus ***DEUTERAGENIA*** Šustera	
bifasciatus (Geoffroy)	[*intermedia* (Dahlbom)]
nitidus (Haupt)	[*hircana* (Fabricius)]
variegatus (Linnaeus)	
AUPLOPUS Spinola	[*Pseudagenia* Kohl]
carbonarius (Spinola)	
POMPILUS Fabricius	
cinereus (Fabricius)	[*plumbeus* (Fabricius)]

AGENIOIDEUS Ashmead	[*Pompilus* Fabricius]
Subgenus ***GYMNOCHARES*** Banks	
cinctellus (Spinola)	
———	[*sericeus* (Vander Linden) deleted]
ARACHNOSPILA Kincaid	[*Pompilus* Fabricius]
Subgenus ***ARACHNOSPILA*** Kincaid	
rufa (Haupt)	
Subgenus ***ANOPLOCHARES*** Banks	
minutula (Dahlbom)	
spissa (Schiødte)	
Subgenus ***AMMOSPHEX*** Wilcke	
anceps (Wesmael)	[*trivialis* Dahlbom]
consobrina (Dahlbom)	
trivialis (Dahlbom)	[*unguicularis* Thomson]
wesmaeli (Thomson)	
EVAGETES Lepeletier	
crassicornis (Shuckard)	[in *Pompilus*]
dubius (Vander Linden)	
pectinipes (Linnaeus)	[new to list]

ANOPLIUS Dufour	
Subgenus ***ANOPLIUS*** Dufour	
caviventris (Aurivillius)	[*piliventris* (Morawitz)]
concinnus (Dahlbom)	
nigerrimus (Scopoli)	
Subgenus ***ARACHNOPHROCTONUS*** Howard	
infuscatus (Vander Linden)	
viaticus (Linnaeus)	[*fuscus* (Linnaeus)]
EPISYRON Schiødte	
rufipes (Linnaeus)	
APORUS Spinola	
unicolor Spinola	
HOMONOTUS Dahlbom	
sanguinolentus (Fabricius)	
CEROPALES Latreille	
maculata (Fabricius)	
variegata (Fabricius)	

Summary of nomenclatural changes

New synonymy

Boreopompilus Wolf **syn. n.** of *Ammosphex* Wilke
Carinevagetes Wolf **syn. n.** of *Evagetes* Lepeletier
Anoplius pannonicus Wolf **syn. n.** of *Pompilus piliventris* Morawitz
Aporus femoralis Vander Linden **syn. n.** of *Aporus unicolor* Spinola
Ceropales semiannulatus Curtis **syn. n.** of *Evania maculata* Fabricius
Pompilus castor Kohl **syn. n.** of *Aporus unicolor* Spinola
Pompilus dispar Latreille **syn. n.** of *Sphex sanguinolenta* Fabricius
Pompilus femoralis Dahlbom **syn. n.** of *Sphex hyalinata* Fabricius
Pompilus hircanus Fabricius **syn. n.** of *Ichneumon bifasciatus* Geoffroy
Pompilus minor Herrich-Schaeffer **syn. n.** of *Pompilus infuscatus* Vander Linden
Pompilus sepicola Smith **syn. n.** of *Sphex perturbator* Harris
Salius notatulus Saunders **syn. n.** of *Sphex hyalinata* Fabricius

NAMES RECALLED FROM SYNONYMY

Caliadurgus Pate **nom. rev.**
Pompilus agilis Shuckard **sp. rev.**
Pompilus fasciatellus Spinola **sp. rev.**
Pompilus piliventris Morawitz **sp. rev.**

NEW COMBINATION

Priocnemis hyalinata (Fabricius) **comb. n.**

NEW SPECIES

Dipogon (*Deuteragenia*) *vechti* **sp. n.**

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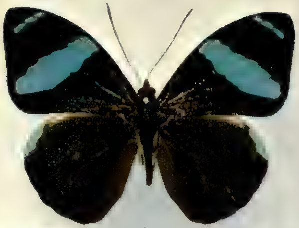
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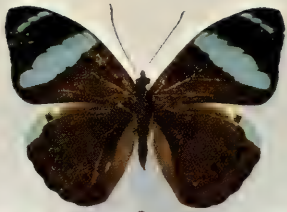
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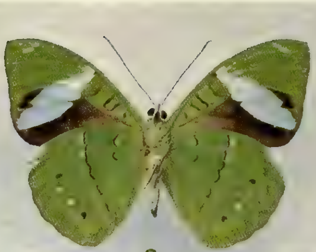
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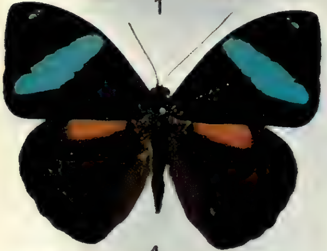
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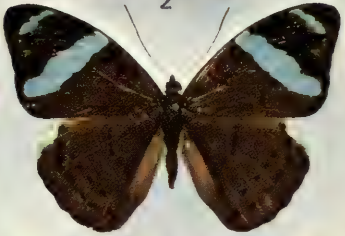
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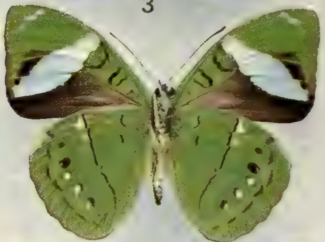
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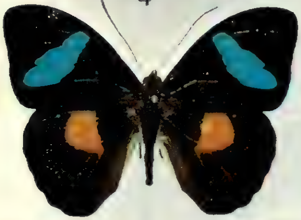
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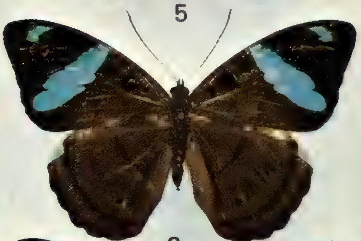
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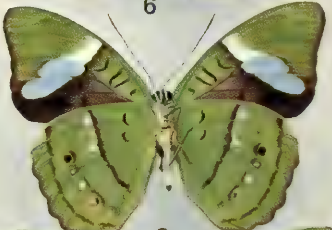
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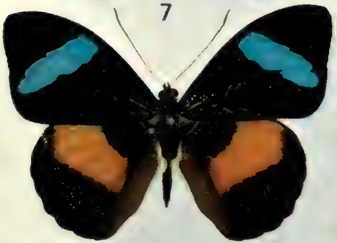
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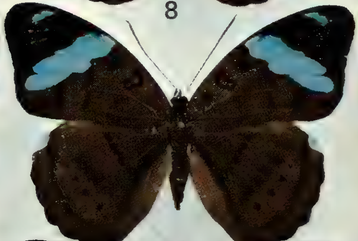
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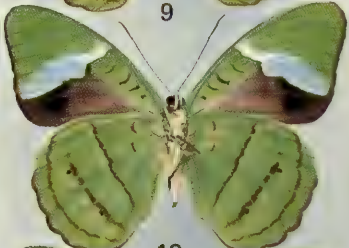
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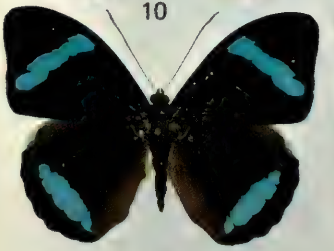
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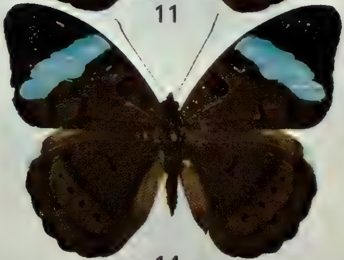
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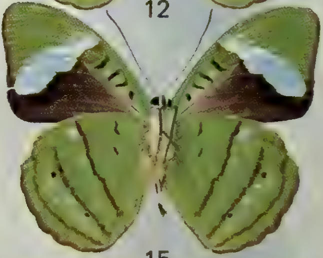
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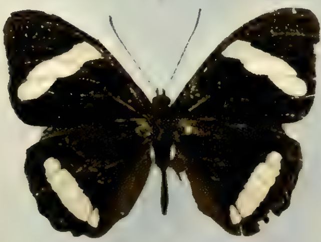
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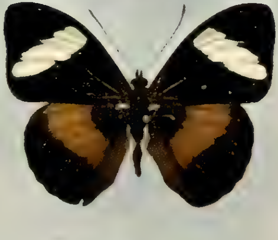
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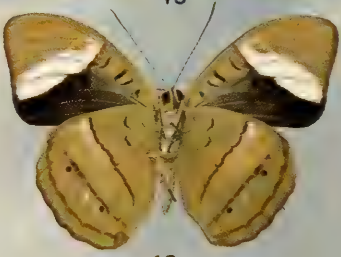
18

FRONTISPIECE

The five species of *Nessaea*

Figs 1–3 *N. regina* (Salvin). (1) ♂, Venezuela; (2) ♀, Venezuela; (3) underside (♂), Venezuela.

Figs 4–6 *N. aglaura* (Doubleday). (4) ♂, Rio Dagua, Colombia; (5) ♀, San Pedro Sula, Honduras; (6) underside (♂), Rio Dagua, Colombia.

Figs 7–9 *N. batesii* (Felder & Felder). (7) ♂, French Guiana; (8) ♀, Pará, Brazil; (9) underside (♀), French Guiana.

Figs 10–12 *N. ancaea* (Linnaeus). (10) ♂, Iquitos, Peru; (11) ♀, Iquitos, Peru; (12) underside (♀), Iquitos, Peru.

Figs 13–15 *N. hewitsoni* (Felder & Felder). (13) ♂, Iquitos, Peru; (14) ♀, Iquitos, Peru; (15) underside (♂), Iquitos, Peru.

Figs 16–18 Individuals lacking blue pterobilin pigment. (16) *N. hewitsoni*, ♂, La Merced, Peru; (17) *N. ancaea*, ♂, Berbice River, Guyana; (18) *N. ancaea*, ♂, underside, Manaos, Brazil (holotype of *Nessaea lesoudieri* Le Moult).

The coloration, identification and phylogeny of *Nessaea* butterflies (Lepidoptera : Nymphalidae)

R. I. Vane-Wright

Department of Entomology, British Museum (Natural History), Cromwell Road, London SW7 5BD

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Synopsis

The coloration of the five species of neotropical nymphalid butterflies belonging to the genus *Nessaea* is discussed. It appears that the development of a brilliant blue pterobilin pigment has been exploited for both specific signalling and cryptic functions. An explicit phylogeny for the five species, based on wing pattern element homologies, is presented, and compared with results from biometric data. Convergence of two characters is postulated. Predictions of the use of colour pattern differences as isolating mechanisms, and about possibilities of hybridisation, are derived from the phylogenetic hypothesis. Three basic pattern morphs are recognised for the genus and pathway models for their evolution are outlined. It is thought possible that the evolution of one of the species has involved decoupling of the present male (female-like) pattern. The single sister-species pair recognised in the genus is considered, on present evidence, to fit a sympatric speciation model better than an allopatric one. To assist future work on the group, a key for the identification of adults is included, together with a taxonomic revision and notes on the known biology of the species. Six lectotypes are designated and one new synonym is established.

Introduction: the coloration of *Nessaea*

The five species of *Nessaea* Hübner, a neotropical genus of nymphalids, are remarkable for their possession of a brilliant blue pterobilin pigment (Choussy & Barbier, 1973). Although structural blues are widespread, pigmentary blues are rare in the visible patterns of adult butterflies (Vuillaume, Choussy & Barbier, 1970; Choussy & Barbier, 1973; Bois-Choussy, 1977). Bright blue coloration in butterflies seems generally to be connected with epigamic or intrasexual functions (Huxley, 1938). This is suggested by its common limitation to the male sex, or greater brilliance

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in the male, together with its rare use in mimetic or other defensive patterns (Huxley, 1976). A reasonable but largely untested hypothesis concerning butterfly wing colours is that it is their spectrophotometric properties, not their ultimate mode of production, which is of prime biological significance. *Nessaea* species would thus make interesting subjects for comparison with butterflies which might prove to have spectrophotometrically similar blue colours, but produced by structural means.

Although the females of all five *Nessaea* species are virtually identical in overall pattern and coloration, the males are mostly differentiated in a simple but striking way. In two large areas, two different pairs of the species fly together. Behavioural investigations of these species could yield insight into the function of male pattern differentiation.

Both sexes of all the *Nessaea* species are almost identical on the underside, being a unique apple-green colour, only lightly patterned. Bryk (1953 : 104) speculated that this coloration was cryptic in function. This is confirmed by Hall (unpublished MS), who writes 'The bright green coloration of the under surface exhibited by this group is so highly protective owing to harmonisation with the colour of the leaves that it is surprising that so few butterflies have developed it. On one occasion I was following a specimen of [*Nessaea*] *aglaura* in Costa Rica and noticed that when it settled on a bush it seemed to completely disappear, and it was some time before I detected it sitting fully exposed on a leaf.' Bates (1866 : 175) says of *N. ancaea* that 'During the first few weeks of our explorations in the forests near Pará, at the mouth of the Amazons, no single object gave greater pleasure to Mr. Wallace and myself than this handsome insect, shooting like a meteor athwart the paths of the palm swamps, and settling on the broad glossy leaves of the wild banana and other plants. It was exceedingly wary, and we never succeeded in capturing one, when settled, if we had to walk a few steps to reach the place where it sat. The slightest movement was sufficient to startle the creature . . .' Talking of the *Catonephele*/*Nessaea* group in general, Bates (1886 : 174) says '. . . they do not issue from the forest on fine days to sport about in open sunny places, but remain all their lives in the shades. They love to glide through the less dense places, where the wilderness has been a little thinned by the uprooting of gigantic trees, or by the destruction of timber by the inhabitants, and settle on leaves where a ray of sunlight penetrates. In flight they are excessively rapid, and show but little of that floating motion which distinguishes *Limenitis* and many other genera. I have never noticed them to settle on the ground, and very seldom on flowers, their habit being to alight for a few moments on leaves, and imbibe the small quantities of moisture which are sometimes found on them.' Thus, although Hall's statement is not directly confirmed by Bates, the latter's observations are consistent with the idea that the green underside is cryptic. Davis (1928 : 83) indicates that *Nessaea* sit on leaves with their bright colours fully exposed, but according to Professor Keith Brown (pers. comm.), they close their wings when alarmed. Professor Brown also suggests that the blue and orange colours have a disruptive effect, as with the orange of *Catonephele*.

Rare specimens of *Nessaea* may be found in which the blue is largely absent. In extreme cases, the underside of such individuals is not green, but yellow (Fig. 18). The green colour, therefore, is apparently produced by an intimate mixture (within the scales) of the pterobilin (Choussy & Barbier, 1973) blue with a yellow pigment. Thus it seems the production of the blue pigment has been used in two ways by these insects. First, to form a pigmentary green on the underside, possibly providing a eucryptic coloration not exploited by many adult butterflies, and secondly, to give a brilliant blue on the upperside, probably used in one or more epigamic or intrasexual signal functions connected with the speciation of the original stock.

The following review of the species, their identification, distribution, relationships and colour differentiation, is provided in the hope that workers may be stimulated to investigate experimentally the significance of the colour patterns of these insects.

Identification and taxonomy

NESSAEA Hübner, [1819]

Nessaea Hübner, [1819] : 41. Type-species by selection of Hemming (1943 : 28): *Papilio ancaeus* Linnaeus.

Nessaea Hübner; Stichel, 1899; Röber, 1915: 481.
[*Catonephele* Hübner; auctt. (in part).]
[*Epicalia* Doubleday; auctt. (in part).]

The present recognition of the genus *Nessaea*, and its species, is due to Stichel (1899). *Nessaea* can be considered a monophyletic unit on the basis of the virtually identical structure of all five species, coupled with the presumed apomorphous character of producing pterobilin pigment in the adults.

The following key, although hardly necessary for males (see colour Figs), hopefully provides a firm basis for the identification of the females, all of which hitherto have often been misidentified. The nomenclature for wing pattern elements is based on Schwanwitsch (1924), as illustrated in Fig. 27.

Key to adults of the species of *Nessaea* Hübner

1 Discal cell of upperside fore wing velvet black, second discalis, if present, reddish, indistinct: males 2
– Discal cell of upperside fore wing brownish, second discalis always present, distinct, centrally reddish brown: females 6
2 Upperside hind wing without bright orange band or marking, but with blue externae in cell R_1 3
– Upperside hind wing almost always with bright orange band or marking, but blue externae in cell R_1 lacking 4
3 Upperside hind wing with blue submarginal band (Fig. 13, rarely white, Fig. 16) . **hewitsoni** (p. 41)
– Upperside hind wing without blue submarginal band (Fig. 1) . . . . . **regina** (p. 34)
4 Orange marking on upperside hind wing small (very rarely absent), restricted to central portions of cells R_1 and R_s (Fig. 4) . . . . **aglaura** (p. 34)
– Orange marking of upperside hind wing larger, extending across wing disc posterior to cell R_s 5
5 Orange band of upperside hind wing broad, extending close to margin in cell R_s (Figs 10, 17) **ancaea** (p. 38)
– Orange band of upperside hind wing restricted, not extending close to margin in cell R_s (Fig. 7) **batesii** (p. 36)
6 Fore wing upperside lacking apical blue spots in radial cells (Fig. 14) . . . . **hewitsoni** (p. 41)
– Fore wing upperside with apical blue spots in radial cells 7
7 Apical blue spots on upperside fore wing present in cells R_3 and R_4, but generally absent from R_5; if present in cell R_5, the spot is small, displaced basally, forming a comma-like marking in combination with the spots in R_3 and R_4 8
– Apical blue spots of upperside fore wing clearly present in three cells, R_3, R_4 and R_5, placed in a more or less straight transverse line 9
8 Inner portions of circuli on hind wing underside conjoined to form a semi-continuous line just proximal to and parallel with the ocellar pupils (when rarely not so conjoined, that portion in cell Cu_1 curved outward towards ocellar pupil); second discalis of hind wing underside brown; outer margins of blue markings in cells Cu_1 and Cu_2 of fore wing underside without any trace of black, dark scales (Figs 11, 12) . . . . . . **ancaea** (p. 38)
– Inner portions of circuli on hind wing underside not conjoined to form a line (that in cell Cu_1 being curved inwards towards base of wing, around ocellar pupil); second discalis of hind wing underside blackish; outer margins of blue markings in cells Cu_1 and Cu_2 of fore wing underside sullied with dark blackish scales (Figs 8, 9) . . . . . . **batesii** (p. 36)
9 Externae of hind wing underside at least faintly marked, usually quite strongly so; species occurring from *Mexico south through Central America to west Colombia and west Ecuador* (Fig. 5) . . . . **aglaura** (p. 34)
– Externae of hind wing underside obsolete, or almost so; species only known from *northern Venezuela* (*and doubtfully north-eastern Colombia*) (Fig. 2) . . . . . **regina** (p. 34)

Throughout the sections below the following abbreviations are used.

BMNH	British Museum (Natural History), London.
BMB	Booth Museum, Brighton, Sussex, England.
LMM	Liverpool Municipal Museum, Liverpool.
MLU	Museum Ludovica Ulrica, Uppsala, Sweden.
MNHN	Muséum National d'Histoire Naturelle, Paris.

MNRJ Museu Nacional, Rio de Janeiro, Brazil.
UMO University Museum, Oxford, England.

Nessaea regina (Salvin)
(Figs 1–3)

Epicalia regina Salvin, 1869 : 178. LECTOTYPE ♂, VENEZUELA (BMNH), here designated [examined].
Catonephele obrinus var. *regina* (Salvin); Kirby, 1871 : 203.
Nessaea regina (Salvin); Stichel, 1899 : 44, pl. 1, figs 14a, b (♂ genitalia); Röber, 1915 : 481, pl. 99, row b (♂).

Epicalia regina was described from an unstated number of male and female specimens from 'Caraccas, collected by *A. Goering*'. The BMNH now possesses a male specimen bearing the labels /Caraccas, Venezuela, Goering/ Type of Epicalia regina Salv./ Godman-Salvin Coll. 1915–3/ BM type no. Rh. 9304/. This specimen is hereby designated lectotype of *Epicalia regina* Salvin, and has been so labelled. A female specimen, bearing similar data labels (type no. Rh. 9305), has been labelled paralectotype.

MATERIAL EXAMINED. 8 ♂, 12 ♀ in BMNH. 6 ♂ and 1 ♀ in BMB (Arthur Hall collection).

VARIATION. There is a slight variation in the intensity of the dark markings of the hind wing underside, and in the development of the apical spots of the fore wing upperside. One male in the BMNH has an additional small triangular blue marking in the fore wing discal cell (upperside).

BIOMETRICS. See Table 1.

DISTRIBUTION (Fig. 28). **Venezuela:** San Esteban; Las Quiguas, Esteban Valley; Caracas; Puerto Cabello. **Colombia** ?

This species seems to be known reliably only from the San Esteban area of northern Venezuela. There is a single male in the BMNH collection labelled 'Colombia' (ex Mus. A. Kuwert, 1894; ex Oberthür coll.). Conceivably *regina* might occur in north-eastern Colombia. Davis (1928 : 82–83) records this species from W. Belize, but I believe he must have been in error, probably mistaking female *aglaura* for *regina*. Drummond (1976 : 44) records *regina* from E. Ecuador; presumably a misidentification of female *ancaea* (or perhaps *hewitsoni*).

BIONOMICS. I have not found anything recorded of the early stages or adult behaviour of this species. It has been found during August and September, at altitudes from sea-level to 4000 ft [1300 m] (Arthur Hall, unpublished MS).

Nessaea aglaura (Doubleday)
(Figs 4–6)

Epicalia aglaura Doubleday, [1848] : pl. 29, fig. 3. LECTOTYPE ♂, MEXICO (BMNH), here designated [examined]. (Date and authorship: Hemming, 1941 : 448.)
Epicalia ancaea Linnaeus var. *aglaura* Doubleday; Westwood, [1850] : 258.
Catonephele obrinus var. *aglaura* (Doubleday); Kirby, 1871 : 203.
Nessaea aglaura (Doubleday); Stichel, 1899 : 44, pl. 1, figs 13a, b (♂ genitalia); Röber, 1915 : 481, pl. 99, row c (♂, [poor] ♀).
Nessaea thalia Bargmann, 1928 : 184. LECTOTYPE ♂, COLOMBIA (BMNH), here designated [examined].
Nessea [sic!] *aglaura* (Doubleday); Davis, 1928 : 83.
[*Nessea* [sic!] *regina* (Salvin); Davis, 1928 : 82. ? Misidentification.]
Nessaea aglaura ecuadorensis Talbot, 1932 : 194. Holotype ♂, ECUADOR: St Ana Maria, Quevedo (*I. von Buchwald*), pres. J. J. Joicey Esq., BM 1931–291 (BMNH) [examined].
Nessaea thalia Bargmann ♂ ab. *margaretha* Krüger, 1933 : 240. 2 ♂, COLOMBIA: 'Rio Dagua' (coll. R. Biedermann).

Epicalia aglaura Doubleday was described from an unstated number of specimens which, according to Westwood ([1850] : 258), came from Mexico and belonged to the BMNH collection. The BMNH now possesses a single male bearing the labels /Mexico, Oajaca, Pur, from Hartweg,

Table 1 Biometric data for *Nessaea*. Mean values, together with standard deviation (s) and number of individuals measured (n), for male and female fore wing length (fwl, base-tip R_3), antennal length (anl) and fore wing length/antennal length ratio (f/a) of the following samples (all in BMNH, except for 6 ♂ and 1 ♀ *regina* in BMB): *regina* (N. Venezuela only); *aglaura* (1) Central America, (2) Colombia, (3) Ecuador; all *aglaura* (1+2+3); *ancaea* (1) Guyana shield, (2) lower Amazon, (3) Mato Grosso, (4a) upper Amazon, Iquitos subsample, (4b) middle–upper Amazon subsample, (5) Andes (Ecuador, Peru and Bolivia); *hewitsoni* (1) Rio Madeira, (2) São Paulo de Olivença, (3) E. Peru, (4) N. Andes (Colombia, Peru and Ecuador), (5) S. Andes (Bolivia).

	♂ fwl	s	n	♀ fwl	s	n	♂ anl	s	n	♀ anl	s	n	♂ f/a	s	n	♀ f/a	s	n
regina	32·58	1·27	14	34·00	1·05	13	18·66	1·00	14	17·88	0·68	12	1·75	0·039	14	1·90	0·041	12
aglaura (1)	33·71	1·75	21															
aglaura (2)	35·32	0·67	5															
aglaura (3)	31·76	0·69	7															
aglaura (all)	33·54	1·81	33	36·07	2·16	14	19·12	1·23	29	19·26	1·25	12	1·76	0·059	28	1·88	0·039	12
batesii	33·57	1·29	44	37·09	1·73	25	19·66	0·90	40	19·15	1·06	21	1·71	0·046	40	1·94	0·052	21
ancaea (1)	30·88	1·22	21	32·19	3·00	15	17·39	1·01	17	16·48	1·53	13	1·78	0·047	17	1·93	0·038	13
ancaea (2)	33·31	1·92	41	35·04	2·49	34	18·35	1·23	40	17·92	1·44	30	1·82	0·051	40	1·96	0·049	30
ancaea (3)	34·08	2·15	5	36·45	0·35	2	18·65	1·05	4	18·85	0·07	2	1·79	0·020	4	1·93	0·026	2
ancaea (4a)	35·50	1·18	44	37·74	1·45	27	20·15	0·89	35	19·37	0·85	19	1·76	0·045	35	1·94	0·038	19
ancaea (4b)	35·55	1·17	34	37·90	3·14	19	20·24	0·88	26	19·65	1·18	17	1·76	0·040	26	1·92	0·085	17
ancaea (5)	37·26	1·89	17	38·08	1·71	6	20·92	1·21	16	19·23	0·79	6	1·78	0·040	16	1·98	0·037	6
hewitsoni (1)	35·01	0·88	12	37·06	1·59	5	19·57	0·68	11	19·22	0·91	5	1·79	0·042	11	1·93	0·031	5
hewitsoni (2)	36·14	1·22	17	38·03	0·66	4	20·36	0·88	16	19·27	0·67	3	1·77	0·037	16	1·98	0·030	3
hewitsoni (3)	36·72	0·90	28	38·69	0·96	10	20·92	0·55	23	19·96	0·62	9	1·76	0·042	23	1·93	0·038	9
hewitsoni (4)	36·97	1·02	38	38·07	1·33	11	20·63	0·74	32	19·63	0·60	10	1·79	0·043	32	1·93	0·037	10
hewitsoni (5)	37·69	1·17	23	38·97	1·33	6	20·87	0·87	22	20·05	0·86	6	1·81	0·046	22	1·95	0·046	6

44.17.2314a/aglaura D. & Hew. pl. 29 fig. 3/BM type no. Rh. 9306, *E. ancaea*, v. *aglaura*, D.W.H. ♂/. This specimen is here designated lectotype of *Epicalia aglaura* Doubleday, and has been so labelled.

Nessaea thalia Bargmann was described from six specimens from 'West Columbien' in the Bargmann collection. The BMNH now possesses a male specimen bearing the labels /Thalia ♂ type Bargmann Solano S.W. Columb./ 61.28/ Presented J. J. Joicey Esq., BM 1931–291/. This specimen is here designated lectotype of *Nessaea thalia* Bargmann, and has been labelled accordingly. Two further males in the BMNH (ex Levick Bequest, BM 1941–83) labelled /thalia ♂, Cotype, W. Col./Solano W. Col./ 148/ ex Kruger 5.3.29/, and /thalia, Cotype, Dagua/ 149/ ex Kruger 5.3.29/ have been labelled as paralectotypes. Three more Dagua males in the BMNH, possibly the three other syntypes, ex Joicey Bequest, have been labelled as ? paralectotypes.

Nessaea aglaura ecuadorensis. In addition to the holotype specimen indicated above, the BMNH also possesses two of the four male paratypes. The remaining two male paratypes are in Liverpool Municipal Museum, where I have examined them, ex G. Talbot collection (Ford, 1954 : 196).

Nessaea thalia ♂ ab. *margaretha* Krüger was described from two males in the Biedermann collection, originally received within a long series of Colombian *Nessaea* sent to Krüger by Werner Hopp. According to the original description the size of the hind wing orange marking was variable in this series, and the two 'margaretha' specimens lacked the orange altogether. I have not traced the whereabouts of these potentially important specimens (if indeed they still exist). The lack of orange in these Colombian *aglaura* males is reminiscent of *regina*. However, the males of the two species should be separable by the lack of the blue externae in upperside cell R_1 of the hind wing of *aglaura*, and its presence in *regina* (but see p. 48).

MATERIAL EXAMINED. 35 ♂, 14 ♀ in BMNH. 7 ♂, 4 ♀ in BMB. 2 ♂ in LMM.

VARIATION. At present the species is divided into three subspecies: typical *aglaura* from Central America (Mexico to Panama), subspecies *thalia* from W. Colombia and subspecies *ecuadorensis* from W. Ecuador. There is perhaps some justification for this, as Colombian *aglaura* has less orange (note also the 'margaretha' specimens described above) but is larger than the populations to the north or south. Apart from this, variation is rather minor, except for considerable variation in the apical blue spotting of the male fore wing upperside, and some general variation in the amount of orange.

BIOMETRICS. See Table 1.

DISTRIBUTION (Fig. 28). **Mexico; Belize; Guatemala; Honduras; Nicaragua; Costa Rica; Panama:** Chiriqui. **Colombia:** Cauca; Dagua; Solano; ? Quibdo, Chocá, 10 km E (*K. S. Brown*). **Ecuador:** Quevedo; Chimborazo.

BIONOMICS. Hall (unpublished MS; see p. 32 above) has described the cryptic behaviour of the adult. Davis (1928 : 83), however, states that the species is 'fond of settling on the leaves of low bushes with the wings fully expanded . . . to show its beautiful colours'. I have seen records for February, June, July, August, September and October; the species probably flies in all months of the year. Ross (1976 : 120), who found the butterfly between sea-level and 2000 ft [650 m] in the Sierra de Tuxtla, Mexico, states that the species 'is uncommon in the Sierra; most specimens were collected in trap nets (using mangoes as bait) that were placed in the small patches of Semi-Evergreen Seasonal Forest bordering Lago Catemaco. The flight is characteristic of most members of the family.' Later, Ross (1976 : 239) lists *N. aglaura* as an indicator species of semi-evergreen seasonal forest. So far as I am aware, nothing is known of the early stages.

Nessaea batesii (Felder & Felder)

(Figs 7–9, 19, 20)

[*Papilio obrinus* Linnaeus; Walch, 1775 : 128, pl. 6, figs 1a, 1b. Misidentification.]

Epicalia batesii Felder & Felder, 1860 : 237, pl. 3, fig. 3. LECTOTYPE ♂, BRAZIL [Belém] (BMNH), here designated [examined].

Epicalia batesii Felder & Felder; Bates, 1864 : 201–202; Bates, 1866.

Catonephele batesii (Felder & Felder); Kirby, 1871 : 203; Aurivillius, 1882 : 65.

Nessaea batesii (Felder & Felder); Stichel, 1899 : 43–44, pl. 1, figs 12a, b (♂ genitalia); Röber, 1915 : 481, pl. 99, row c (♂); de Lesse, 1970 (chromosome number, n = 11).

Nessaea batesi magniplaga Röber, 1928 : 68. Holotype ♂, [GUYANA]: 'brevifascia, type/ Buenavista-75 km. nordwestl. Santa Cruz – 450 m. 1926–7–Bolivien/ Coleção Julius Arp' (MNRJ) [colour photographs examined].

Epicalia batesii Felder & Felder was described from an unstated number of male specimens collected on the Amazon by H. W. Bates. The BMNH now possesses a male specimen bearing the labels /Amazon, Bates, type/ 114 / Batesii n./ Felder Colln./ Rothschild Bequest BM 1939–1/. This specimen is here designated lectotype of *Epicalia batesii* Felder & Felder, and has been so labelled. There are two further Bates' male specimens in the BMNH, both received through the Godman–Salvin collection. One of these bears a label /S. Paulo, U. Amazons, H. W. Bates/, but this must be in error, as Bates (1886 : 177) makes it clear that he only found this species at Belém.

Nessaea batesi magniplaga Röber was described as from Buenavista, Bolivia, in an upper part of the Rio Madeira drainage system, and the unique type stated to be in the Kotzsch collection, Dresden–Blasewitz. Arthur Hall (unpublished MS) was evidently inclined to reject *magniplaga*, and suggested that it must have been based on a mislabelled Guyana male, specimens of which fit Röber's description. This is confirmed by K. S. Brown's surprising discovery of the type, under the name 'brevifascia', in the MNRJ, Brazil (Figs 19, 20). Professor Brown has kindly sent me excellent colour photographs of the specimen, and I have no doubt that Röber's *magniplaga* applies to Guyanese *batesii*. Many workers would no doubt divide *batesii* into two subspecies, one for the lower Amazon region (subspecies *batesii*), and one for the Guyanas (subspecies *magniplaga*). Hans Fruhstorfer evidently intended to make this division, as there is an MS 'type', more or less of the *magniplaga* form, from Surinam in the BMNH collection.

MATERIAL EXAMINED. 60 ♂, 29 ♀ in BMNH. 13 ♂, 5 ♀ in BMB. 1 ♂ in UMO.

VARIATION. Variation is generally minor. The BMNH does, however, possess a few 'aberrations'. Two of these are highly asymmetric: a female with the fore wing blue bar almost completely lacking on the left, and a male with the orange marking of the hind wing almost completely lacking on the right. Two female specimens collected at Belém by Goeldi are almost lacking in blue pigment, the fore wing upperside bars being almost white, and the underside variegated, yellowish green. A male from French Guiana has the fore wing blue band sharply narrowed anteriorly.

Populations of *batesii* from the Guyanas have males with a much larger area of orange on the hind wing in comparison to *batesii* from Maranhão and Pará states in Brazil (see Biometrics below). However, there is some evidence for a cline running through the Guyana shield populations, with Guyana males having the most orange (*magniplaga*), French Guiana males the least orange (although still greater than the Amazon males), with those from Surinam perhaps being intermediate. I see little purpose in proposing any formal subdivision, but the name *magniplaga* could be applied to the Guyana shield populations if desired (see above).

BIOMETRICS. See Table 1. Additional data on male variation are as follows. Ratio fore wing length/maximum width male hind wing orange marking: Guyana population, 4·88 (15 specimens, s = 0·42); Surinam population, 4·83 (3 specimens, s = 0·23), French Guiana population, 5·24 (10 specimens, s = 0·22); Pará population, 6·81 (15 specimens, s = 0·76). Maximum width male hind wing orange marking: Guyana population, 7·11 mm (15 specimens, s = 0·68); Surinam population, 6·73 mm (3 specimens, s = 0·45); French Guiana population, 6·38 mm (10 specimens, s = 0·35); Pará population, 4·55 mm (15 specimens, s = 0·45.)

DISTRIBUTION (Fig. 28). **Guyana, Surinam, French Guiana, Venezuela. Brazil:** Maranhão; Pará; Amapá; E. Amazonas. **Ecuador** ?: Rio Napo (single ♀ in MNHN, Paris, which might be genuine!).

BIONOMICS. I have seen records for July, August, September and January–February. Bates' (1866) comments about the behaviour of *N. ancaea* evidently apply to this species also (see above). Bates (1866) was the first to describe the female, as ascertained from a pair taken in copula by Piffard in Guyana. The correctness of this association is confirmed by a pair taken in copula by Miles Moss at Belém, now in the BMNH. Apart from this meagre information, nothing else seems to have been recorded of the biology of this species. The low chromosome number of n = 11 recorded by de Lesse (1970) is interesting; it would be valuable to have confirmation, and values for the other species.

Nessaea ancaea (Linnaeus)
(Figs 10–12, 17, 18, 21, 22)

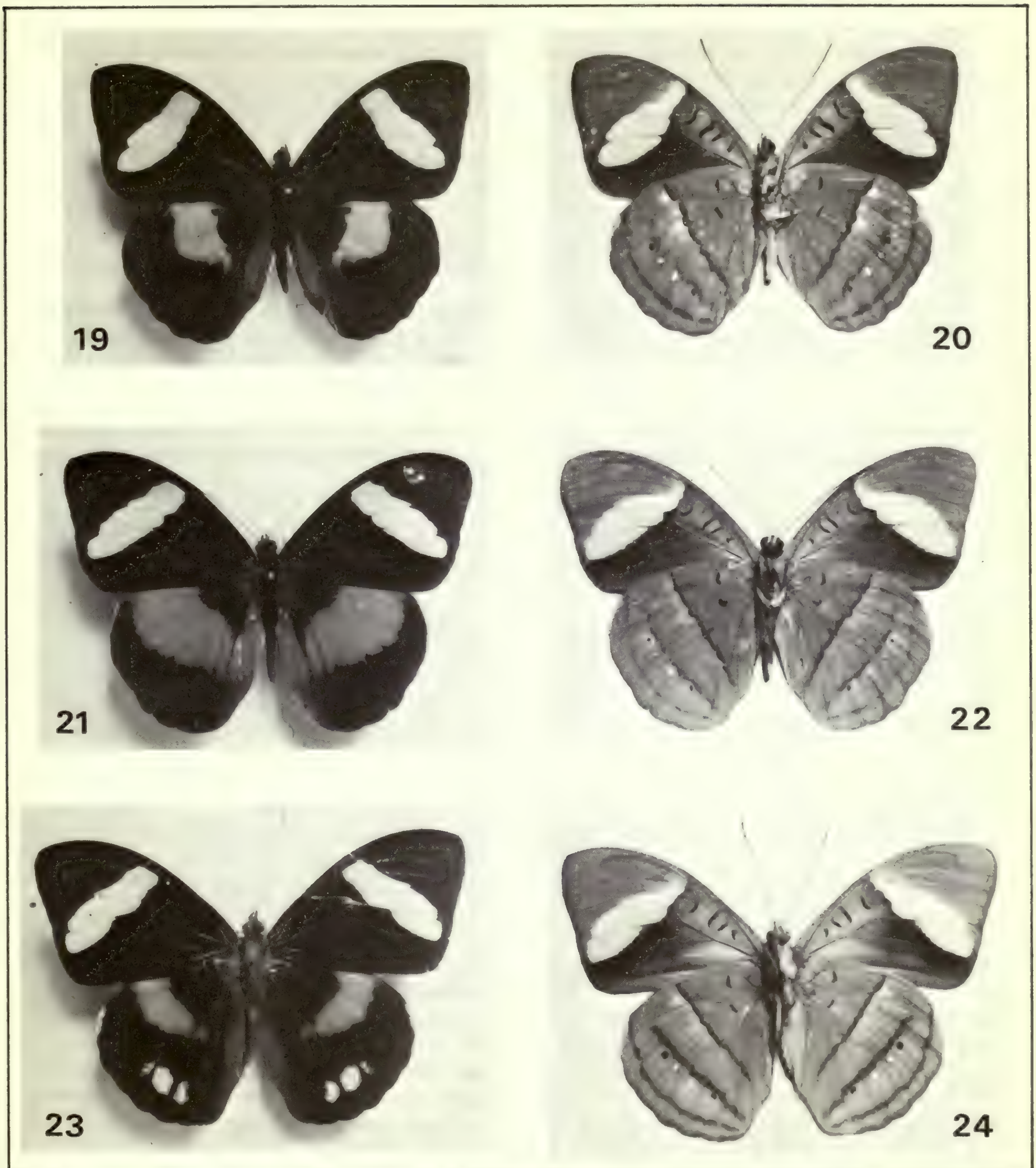
Papilio ancaeus Linnaeus, 1758 : 486. Syntype(s) ♂, 'Indiis' [SURINAM] (MLU).
Papilio obrinus Linnaeus, 1758 : 470. Syntype(s) ♀, 'India' [SURINAM] (MLU).
Papilio ancaeus Linnaeus; Linnaeus, 1764 : 307.
Papilio obrinus Linnaeus; Clerck, 1764 : pl. 31, figs 2, 3 (♂, ♀); Linnaeus, 1764 : 255; Linnaeus, 1767 : 766; Sulzer, 1776 : (1), 143; (2), 32, pl. 16, figs 1, 2 (♂).
Papilio ancaea Linnaeus: Linnaeus, 1767 : 781.
Najas hilaris obrina (Linnaeus); Hübner, [1808] : pl. 58, figs 1–4 (♂, ♀).
Nessaea ancaea (Linnaeus); Hübner [1819] : 41.
Epicalia ancaea (Linnaeus); Westwood, [1850] : 258.
Epicalia ancea [sic!] (Linnaeus); Bates, 1865 : 206.
Catonephele obrinus (Linnaeus); Kirby, 1871 : 203; Aurivillius, 1882 : 64.
Nessaea obrinus Stichel, 1899 : 41, pl. 1, figs 11a, b (♂ genitalia); Röber, 1915 : 481, pl. 99, row b (♂, ♀).
Nessaea obrinus faventia Fruhstorfer, 1910 : 194. LECTOTYPE ♂, BRAZIL: Mato Grosso (BMNH), here designated [examined].
Nessaea obrinus latifascia Röber, 1928 : 68. LECTOTYPE ♂, ? BOLIVIA: East (MNRJ), here designated [colour photographs examined].
Nessaea obrinus ♀ ab. *coniuncta* Krüger, 1933 : 176. 4 ♀, BRAZIL: 'Upper and lower Amazons; Rio Madeira' (coll. Krüger, Leipzig).
Nessaea lesoudieri Le Moult, 1933 : 18, pl. 2, figs 5, 6. Holotype ♂, BRAZIL: Manaos, coll. *Le Moult*, ex E. le Moult Coll. BM 1968–155 (BMNH) [examined]. **Syn. n.**
Nessaea obrinus romani Bryk, 1953 : 103. Holotype ♂, BRAZIL: Amazonas, São Gabriel, Rio Negro, coll. *A. Roman* (Swedish Museum of Natural History, Stockholm).
Nessaea ancaea (Linnaeus); Hemming, 1943 : 28; 1967 : 312.

Papilio ancaeus Linnaeus. The type-material is in the MLU, Sweden. Aurivillius (1882 : 64) discusses the species, but does not indicate how many specimens survive. Clerck figures the male (on which sex *ancaeus* is based) under the name *obrinus*. It is consistent with the most likely type-locality, Surinam.

Papilio obrinus Linnaeus. The type-material is in the MLU, Sweden. Aurivillius (1882 : 64) discusses the species, but does not indicate how many specimens survive. Clerck figures both a female (*obrinus*) and a male (*ancaeus*) under the name *obrinus* (see below, p. 41).

Nessaea obrinus faventia Fruhstorfer was described from an unstated number of specimens from 'Matto Grosso'. The BMNH now possesses a male specimen bearing the labels /Brasilien, M. Grosso, Fruhstorfer/ Type/ obrinus faventia Fruhst./ Fruhstorfer Coll. BM 1937–285. This specimen is here designated lectotype of *Nessaea obrinus faventia* Fruhstorfer, and has been so labelled.

Nessaea obrinus latifascia Röber was described from several male specimens apparently collected at Buenavista, Bolivia, and stated to be in the Kotzsch collection, Dresden–Blasewitz. Arthur Hall (unpublished MS) comments that this [sub]species was unknown to him, and notes that in his opinion specimens from the Mato Grosso Cuiaba–Corumba river system are typical. In the light of the incorrect labelling of *Nessaea batesi magniplaga* (see p. 37), the precise provenance of *latifascia* must remain in doubt. Professor Keith Brown (pers. comm. 22.ix.1977; 8.xii.1977) has discovered a *latifascia* syntype in the MNRJ, Brazil (Figs 21, 22). He suggests that it might have come from farther north-west than Buenavista. This male specimen bears the following labels /latefascia: type/ Buenavista-75 km. nordwestl. Santa Cruz-450 m. 1926–7–Bolivien/ no. 20/ 415/ Coleção Julius Arp/. This specimen is here designated lectotype of *Nessaea obrinus latifascia* Röber, and will be so labelled. From colour photographs kindly sent by Professor Brown, it is apparent that the lectotype is very similar to Mato Grosso *faventia*, having the underside markings faint, and a broad orange band. This is consistent with an origin somewhere on the E. Bolivia/Mato Grosso border.



Figs 19–24 Specimens of *Nessaea* in the MNRJ. Black and white photographs prepared from colour transparencies supplied by Prof. K. S. Brown. (19) upperside; (20) underside, of male holotype of *N. batesi magniplaga* Röber [Guyana]; (21) upperside, (22) underside, of male lectotype of *N. obrinus latifascia* Röber [Bolivia/Mato Grosso]; (23) upperside, (24) underside, of presumed male hybrid *ancaea* × *hewitsoni* (São Paulo de Olivença, Brazil).

Nessaea lesoudieri Le Moult is based on a single male specimen from Manaos, Brazil (Fig. 18) which shows complete absence of the blue pterobilin pigment. This results in a completely yellow underside, which may rarely be seen in certain other *Nessaea* specimens (e.g. Figs 16, 17), where the effect is also manifest as the replacement of the upperside blue with white. So far as I am aware, Bates (1866*b* : 174) is the only person to have drawn attention to such white Nessaeas. At the time of purchase of the *lesoudieri* type for the BMNH, Mr M. P. Clifton pointed out to me the likelihood that the one pigment change was responsible for both upper- and under-side colour shifts. In all other respects *lesoudieri* is identical with normal *ancaea*, and as I do not propose to recognise any formal subdivision of the species here, I have no hesitation in placing *lesoudieri* in synonymy.

Nessaea obrinus romani Bryk was described from a pair collected at São Gabriel on the Rio Negro, Amazonas State, Brazil. From the description it is evidently typical of the *ancaea* found on the upper Amazon system, which are larger than the Guyana region individuals, and have the hind wing orange band narrowed posteriorly.

Nessaea obrinus ♀ ab. *coniuncta* Krüger. This 'aberration' was described from four females in the Krüger collection (Leipzig), collected on the upper and lower Amazon, and on the Rio Madeira. The BMNH includes a single specimen representing this extreme of variation, in which the sub-apical blue spots in R_3–R_5 of the fore wing are 'connected' to the main blue band by two small blue spots in cells M_1 and M_2.

MATERIAL EXAMINED. 189 ♂, 114 ♀ in BMNH. 35 ♂, 14 ♀ in BMB. 3 ♂, 3 ♀ in UMO.

VARIATION. Typical *ancaea* specimens from the Guyana shield are smaller and duller (Fig. 17) than the individuals from the middle and upper Amazon (Manaos and above). Specimens from the lower Amazon (Maranhão; Belém-Santarem; Rio Tapjos; Rio Curuá) have a notably broad hind wing orange band, which contrasts with *ancaea* from the middle and upper Amazon, in which the band is narrowed posteriorly (Fig. 10). The Mato Grosso and Bolivian individuals (Fig. 21) tend to have this orange band slightly broader; Peruvian specimens are intermediate. The Mato Grosso populations may be distinguished by a reduction in the intensity of the underside markings (cf. Fig. 22). On present evidence it might be possible to recognise four subspecies: Guyana shield region (*ancaea ancaea*); Amazon zone below Obidos (unnamed); Amazon above mouth of Rio Madeira, S. Colombia, Ecuador, Peru and Bolivian Andes (*ancaea lesoudieri* = *romani*); and Mato Grosso (*ancaea faventia* = *latifascia*). Professor K. S. Brown (pers. comm.) suggests that populations from Rondônia and to the north-east, having the orange band width intermediate between the *faventia* and *lesoudieri* types, could merit recognition as a fifth subspecies. But I see little to be gained from any formal division; the population structure of such an insect is likely to be far more complex than any such crude division might suggest (cf. Oliver, 1972), especially with the rapid decimation of its forest habitat which is now taking place.

Individual variation is comparable to other *Nessaea* species, rather slight. The 'coniuncta' extreme of variation of the fore wing apical blue spots of the female has been mentioned above. Rare specimens also occur in which the stripe of the hind wing underside composed of proximal ocellar circuli elements is not formed in the normal manner, the elements not being conjoined. In this condition the wing looks similar to that of *batesii*, but may still be separated as indicated in the key (p. 33). A male from Rio Curuá (Pará) in the BMNH shows asymmetry comparable to the *batesii* specimens noted above, with the right fore wing blue band largely infuscated. Bolivian males often show a trace of blue scaling in the position where the upperside fore wing apical blue spots occur in the female. I have seen a single male with a posterior red spot in cell Cu_2 on the hind wing upperside, as found in males of *N. regina*.

BIOMETRICS. See Table 1. For the purposes of the survey, the material was separated into six samples: (1) Guyana shield (Guyana, Surinam and French Guiana); (2) lower Amazon (Maranhão, Pará, Santarem, Rio Tapajos); (3) Mato Grosso; (4a) upper Amazon, Iquitos subsample; (4b) middle and upper Amazon (Manaos to Nauta, Rio Madeira, Rio Putumayo [less Iquitos]); (5) Andes (Ecuador, Peru and Bolivia). As noted above, the first three samples could be treated as separate subspecies on the basis of minor pattern differences, and the last three samples as a fourth. The biometric data could be taken as consistent with such a proposal. It is interesting to note the remarkable correspondence of the mean values of the large Iquitos subsample to the values for the remainder of the middle–upper Amazon sample, although the variance of the females is sharply increased in the latter. But, in my opinion, the overall correspondence of these upper Amazon values to those of sympatric *N. hewitsoni* are even more remarkable (p. 53; Figs 30–32).

DISTRIBUTION (Fig. 28). **Guyana, Surinam, French Guiana, Venezuela. Brazil:** Pará; Maranhão; ?Pernambuco; Mato Grosso; Amazonas: Roraima; Acre; Rondônia; Amapá. **S. Colombia; E. Ecuador; E. Peru; Bolivia.**

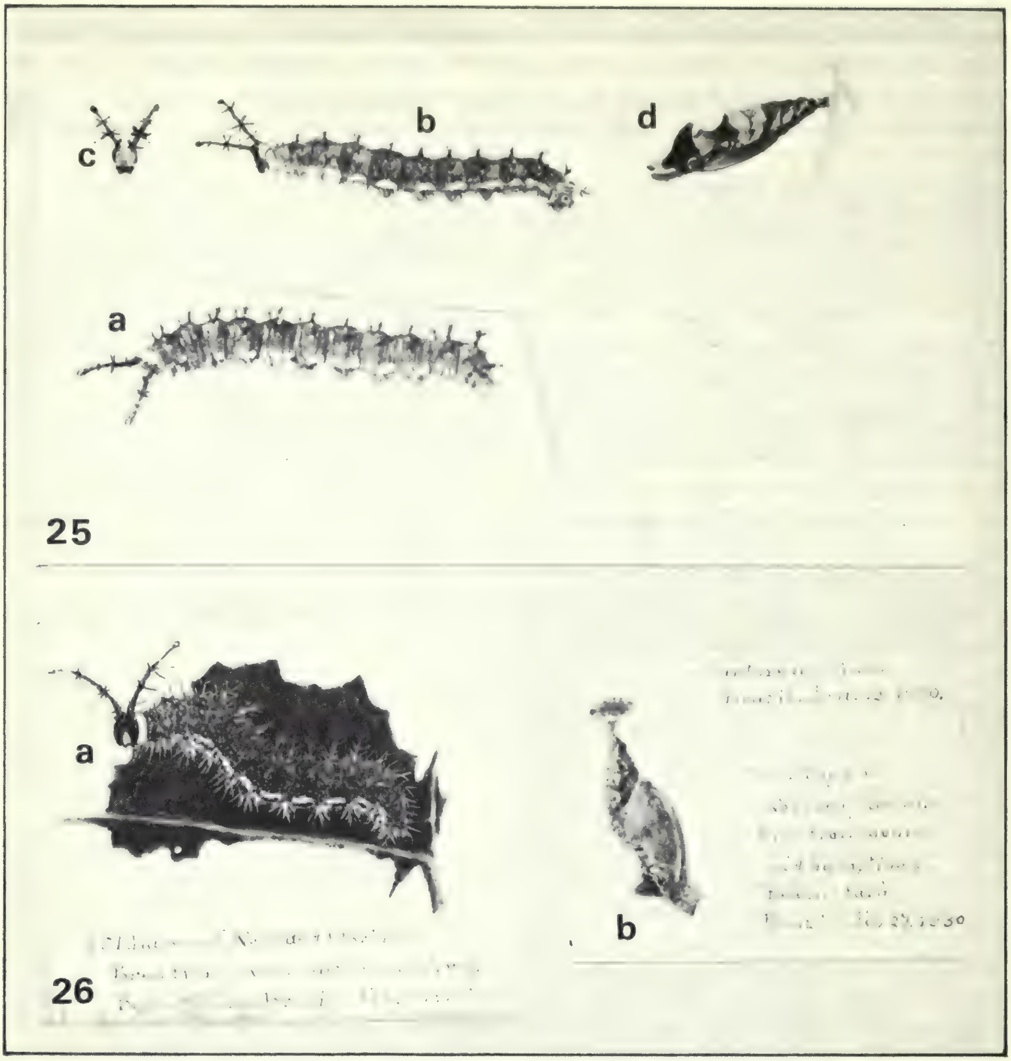
BIONOMICS. Bates (1864; 1866; see p. 32) and Hall (MS) have described a little of the behaviour of the adult. I have seen records for all months of the year; the species probably does not occur much above 1500 m. M. E. Fountaine and Miles Moss (unpublished paintings, BMNH) have figured the larva (Figs 25a, b, c; Fig. 26a), but unfortunately do not mention the food plant. The larva is typically nymphaloid. Head black, marked with red in front, with white collar behind, and two black cephalic processes, each with three groups of spines and a knobbed tip. Thoracic and abdominal segments green, with interrupted white lateral stripe, and possibly some dorsal white spotting; three or four rows of scoli along each side of body, no anal processes. According to Miles Moss the pupa (Fig. 25d) is green, with two blunt anterior processes, a dorsal keel and some restricted brown markings. He includes the cryptic comment 'Same shape, colouration and attitude for *Pyrrhogyra* sp., elevated from upper surface of some leaf (not always its own)'. Moss illustrates the pupa attached to a pendant leaf surface, from which it is thrust out at about 70° to the vertical, i.e. almost horizontal. Fountaine, however, shows the pupa pendant, and of a rather different hue (Fig. 26b).

A NOMENCLATURAL NOTE. *Papilio ancaeus* Linnaeus (1758) is based on the male sex, *P. obrinus* Linnaeus (1758) on the female. I have followed Francis Hemming (1967 : 312), but with some doubt, in applying the name *ancaea* rather than *obrina* to this *Nessaea* species. He states that 'As the specific names *ancaeus* and *obrinus* were published in the same work and on the same date, the relative precedence to be accorded them depends on the choice of the First Reviser. The First Reviser in this case was Hübner when in [1819 : 41] he adopted the specific name *ancaeus* Linnaeus, sinking the specific name *obrinus* Linnaeus as a junior synonym. It is to be noted that a good many modern authors, relying apparently on the so-called Principle of Page-Precedence, have incorrectly followed the opposite course.' However, at least three earlier publications *covertly* recognised the two names as synonymous, and in all of these *obrinus* is used. No less a person than Clerck (1764), in figuring Linnaean types of both names, applies only *obrinus* on the plate, and does not mention *ancaeus*, even in his index. Sulzer (1776) figures *just a male* as *obrinus*, with no mention of *ancaeus*. Finally, Hübner [1808] figures both male and female specimens on the same plate, under the name *Najas hilaris obrina*. Thus I doubt that modern authors have been relying 'on the so-called Principle of Page Precedence', but, like Aurivillius (1882) they have followed the wisdom of 18th century authors who corrected The Master without appearing to do so – *ancaeus* was quietly forgotten. But as Hübner was the first to synonymise explicitly the two names, and as *ancaeus* is now fixed as type-species of *Nessaea*, I agree to call the species *N. ancaea*.

Nessaea hewitsoni (Felder & Felder)
(Figs 13–16)

Epicalia hewitsoni Felder & Felder, 1859 : 269, pl. 5, fig. 1. LECTOTYPE ♂, BRAZIL [São Paulo de Olivença region] (BMNH), here designated [examined].
Epicalia hewitsoni Felder & Felder; Felder & Felder, 1862 : 112.
Catonephele hewitsoni (Felder & Felder); Kirby, 1871 : 202.
Nessaea hewitsoni (Felder & Felder); Stichel, 1899 : 44, pl. 1, figs 15a, b (♂ genitalia); Röber, 1915 : 481, pl. 99, row b (♂, ♀).

Epicalia hewitsoni Felder & Felder was described from an unstated number of specimens from the 'Upper Amazon'. The BMNH now possesses a male specimen bearing the labels /Amazon, Bates, type/ hewitsoni n./ Felder Colln./ Rothschild Bequest BM 1939–1/. This specimen is here



Figs 25, 26 Early stages of *Nessaea ancaea*. (25, a, b, c) three views of larva; (d) pupa (note with pupa: 'Same shape, colouration and attitude for *Pyrrhogyra* sp., elevated from upper surface of some leaf, not always its own'). From paintings by the Rev. Miles Moss (BMNH, unpublished). (26, a) larva; (b) pupa. From paintings by Miss M. E. Fountaine (BMNH, unpublished).

designated lectotype of *Epicalia hewitsoni* Felder & Felder, and has been so labelled. A second Bates specimen, with the data /Amazons, H. W. Bates/ Godman-Salvin Coll. 1915–3/, is present in the BMNH collection, but I do not regard it as a paralectotype. The 'Rio Negro' specimen referred to by Felder & Felder (1862 : 112) is also present in the BMNH collection. An old specimen in the BMB, labelled /St. Paulo, 65–29/, may be an original Bates specimen, but there is no proof of this.

MATERIAL EXAMINED. 126 ♂, 41 ♀ in BMNH. 9 ♂, 2 ♀ in BMB. 3 ♂ in UMO.

VARIATION. The variation of this species is slight. Bolivian specimens of the male have the hind wing blue band reduced in width, the most posterior element frequently being detached as a separate spot. Bolivian individuals also, from the evidence of the BMNH collection, seem to have a tendency for loss of the upperside blue pigment, without concomitant loss of the underside green. In at least one *hewitsoni* from Peru, however (Fig. 16), the blue pigment has been lost entirely from both wing surfaces, giving a white-banded upperside and a yellow underside, as also found in rare *N. ancaea* specimens (Figs 17–18). A single sample from a possibly isolated population on the Rio Madeira, at Humaita, are notably smaller in size, but show no other obvious differences.

BIOMETRICS. See Table 1. Partly to facilitate comparison with *N. ancaea*, and partly to look for heterogeneity within *N. hewitsoni*, the available material was divided into five samples: (1) Rio Madeira; (2) São Paulo de Olivença; (3) E. Peru (Iquitos, Nauta, Pebas); (4) N. Andes (Colombia, Ecuador, Peru); (5) S. Andes (Bolivia). The results lend only marginal support to any idea of subdividing *hewitsoni*. Bolivian specimens are separable on minor differences of the male hind wing band. Although they are also the largest, little should be made of this. As shown by Vane-Wright, Ackery & Smiles (1975), the size of Andean butterflies may vary in a way analogous to 'Bergmann's Rule' (Ray, 1960; Lindsey, 1966; McNab, 1971): we might well expect Bolivian *hewitsoni* to be the largest.

DISTRIBUTION (Fig. 28). **Brazil:** Rio Madeira; São Paulo de Olivença; São Carlos, Rondônia; Benjamin Constant. **SE. Colombia:** Meta; Putumayo. **E. Ecuador; Peru. Bolivia.**

BIONOMICS. I have seen records for January, March, April, May, July, August, September, October and November; presumably the species may be found throughout the year. In altitude it ranges from about 100 m up to about 1500 m, sometimes in company with *N. ancaea*. There is a suggestion that *hewitsoni* may range higher in the Andes than *ancaea*, and somewhat further north, into southern Colombia. James Mallet (pers. comm., 23.ii.1978) says of *hewitsoni* in Colombia: 'We only found one species, the form with the blue-barred hindwing. It came to bait occasionally, but then occasionally is how I would describe the way things come to bait in general . . . *Nessaea* did come to sweat, though. Often when I was taking photos of satyrids feeding on fruit falls, *Nessaea* and other nymphalids would swoop down from the canopy and suck sweat from discarded bags, and even the rim of my butterfly net, so it was not difficult to capture them. Otherwise they flew in sun patches and where trees had fallen. They are truly forest species. While we were there they seemed among the commonest *forest* species, but one was lucky to see one (or any of the commoner forest nymphalids) in a day. We caught them in Putumayo: Guzman, near Mocoa, and Villa Garzón, about 250–300 m.'

Nothing has been recorded of the early stages.

Phylogeny

Five species of *Nessaea* are recognised. There are 105 different, strictly dichotomous trees possible for a group of five species (Cayley, 1859; Harding, 1971). The *problem* is to recognise one of these trees as the most probable or parsimonious on available evidence. The *function* of the hypothesis of phylogenetic relationships selected is to make predictions (which may be tested by new data), and to provide an evolutionary hypothesis alternative to any different hypotheses derived by non-phylogenetic methods.

The following discussion is based on the general principles established by the late Professor Willi Hennig, and uses the system of nymphalid wing pattern element homologies originally recognised by Schwanwitsch (1924: fig. 27) and Süffert (1927; 1929) (see Vane-Wright & Huggins, 1972; see also Graham, 1950, for some criticism of the Schwanwitsch/Süffert system). In order to clarify the discussion for those not familiar with Hennig's specialised phylogenetic terms, the following list of definitions relevant to the discussion is included.

Definitions

Degree of phylogenetic relationship. A species *Y* is more nearly related to another species *Z* than to a third species *X*, when *Y* has at least one ancestral species source in common with species *Z*

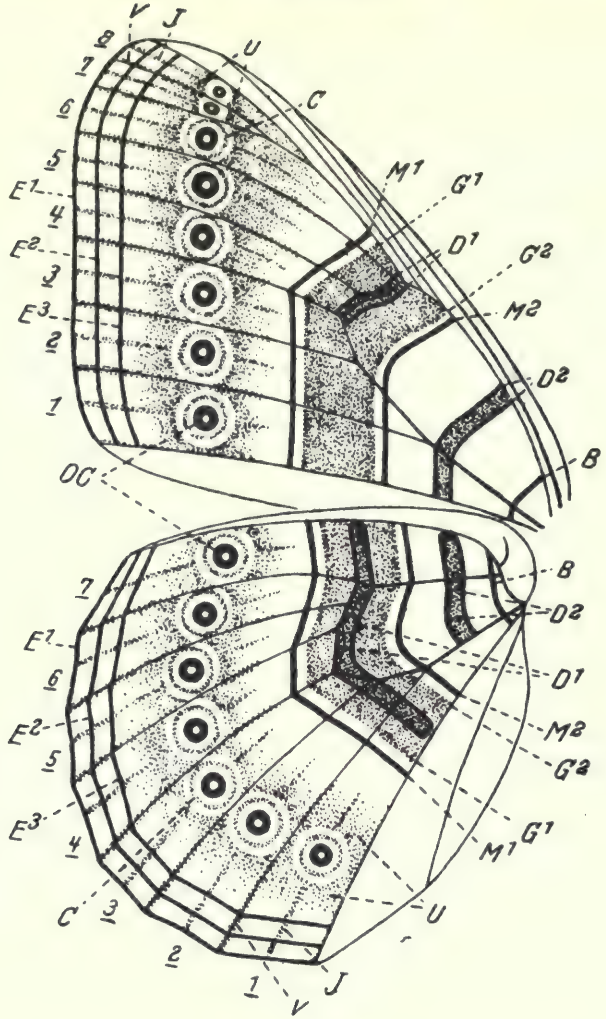


Fig. 27 Ground-plan of nymphalid wing pattern, reproduced from Schwanwitsch (1924). The following elements are referred to in the text: E, externae; U, umbrae; C, circuli: D^1, first discalis; D^2, second discalis.

which is not also an ancestral source of species *X*. Degree of phylogenetic relationship is thus measured in terms of recency of common ancestry.

Plesiomorph. A 'primitive', 'generalised', 'archaic' or 'archetypic' character state.

Symplesiomorphy. Agreement in a plesiomorphic character state between species.

Apomorph. A 'derivative' or 'specialised' character state.

Synapomorphy. Agreement in an apomorphic character state between species.

Monophyletic group. A small or large group of species whose members can be considered to have a closer degree of phylogenetic relationship to one another, than to any species which stands outside the group. Monophyletic groups can only be recognised by their common possession of derivative characters (synapomorphy), and include *all* the descendants of their stem species (see also Patterson, 1978).

Autapomorph. An apomorphic character state unique to a single species or monophyletic group.

Transformation series. States of a character which, across the members of a group of species, can be arranged in a single sequence of increasing apomorphy. Successive levels can be used to define nested monophyletic subgroups.

Sister-species. A pair of species, each of which is the others closest known relative; or, a pair of species arising from a common ancestor which has not given rise to any other living species.

Sister-groups. A pair of monophyletic groups, which can be of any size, each of which is the others closest known relative.

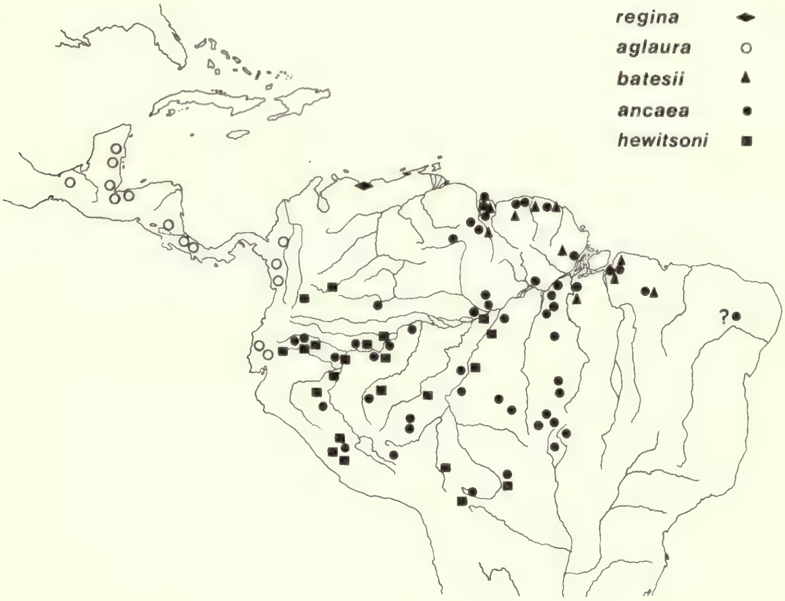


Fig. 28 Distribution of the species of the genus *Nessaea* Hübner (Central and South America). Data obtained mainly from BMNH, BMB, the literature and Professor K. S. Brown.

Characters

The species of *Nessaea* are remarkably similar, except in the generalised signal properties of the male upperside wing pattern. I have only been able to recognise eight potentially synapomorphous character states within the group. These are presented as a character matrix (with the cladogram derived from it) in Fig. 29. The characters are discussed here in turn.

Character 1. The females of all *Nessaea* species have blue externae in cell R_1 on the hind wing upperside. These elements are also present in the males of *regina* and *hewitsoni*, and similar elements may be noted in various species of *Catonephele* (which genus appears to be, or include, the sister-group of *Nessaea*). The more or less complete absence of these blue externae in the males of *aglaura, batesii* and *ancaea* could therefore be considered synapomorphous.

Character 2. The males of *Catonephele* species, and of *Nessaea aglaura*, *N. batesii* and *N. ancaea*, have bright orange areas on the hind wing upperside. The complete absence of orange in *N. regina* and *N. hewitsoni* could therefore be considered synapomorphous.

Character 3. Both sexes of *N. regina* and *aglaura*, and females of *batesii* and *ancaea*, have preapical blue spots (fundamental homologies not yet understood) in cells R_3–R_5 of the fore wing upperside. Their complete absence in *batesii*, *ancaea* and *hewitsoni* males, and their tendency for reduction in *aglaura* males, may be regarded as an apomorphous transformation series.

Character 4. Females of all five *Nessaea* species have a well-marked, reddish, second discalis on the fore wing upperside. This is also present in *regina* males. Its absence in the males of *batesii*, *ancaea* and *hewitsoni*, and reduced state in *aglaura* males, may be regarded as an apomorphous transformation series.

Character 5. Females of all five *Nessaea* species have the transverse blue (medial) band of the fore wing upperside extending anterior to R_2 (immediately distad of the first discalis). This feature is also present in the males of *regina* and *aglaura*. The absence of this anterior section of the blue band in the males of *batesii*, *ancaea* and *hewitsoni* may be regarded as synapomorphous.

Character 6. The pre-apical blue spots of the fore wing upperside (as discussed for character 3), are modified (partly reduced) in the females of *N. batesii* and *ancaea*, and completely absent in *hewitsoni*. This may be considered an apomorphous transformation series for these three species.

Character 7. On the underside of the fore wing in both sexes of *N. regina* and *aglaura*, a dark umbral 'cloud' conjoins the distal margin of the blue transverse band in cells Cu_1 and Cu_2. This marking is reduced to a fine (but constant) marginal line in *batesii*, and is quite absent in *ancaea* and *hewitsoni*, thus apparently forming an apomorphous transformation series in these three species.

Character 8. On the hind wing underside of all *Nessaea* species the outer portions of the ocellar circuli are wanting. In *N. ancaea* and *hewitsoni* the proximal portions are conjoined to form a more or less straight, almost uninterrupted line. This development may be regarded as apomorphic in relation to the more disjunct (plesiomorphous) condition of these elements in the other three species.

	1	2	3	4	5	6	7	8
regina	o	a	O	O	O	O	O	O
aglaura	a	o	A	A	O	O	O	O
batesii	a	o	*A'*	*A'*	A	A	A	O
ancaea	a	o	*A'*	*A'*	A	A	*A'*	A
hewitsoni	o	a	*A'*	*A'*	A	*A'*	*A'*	A

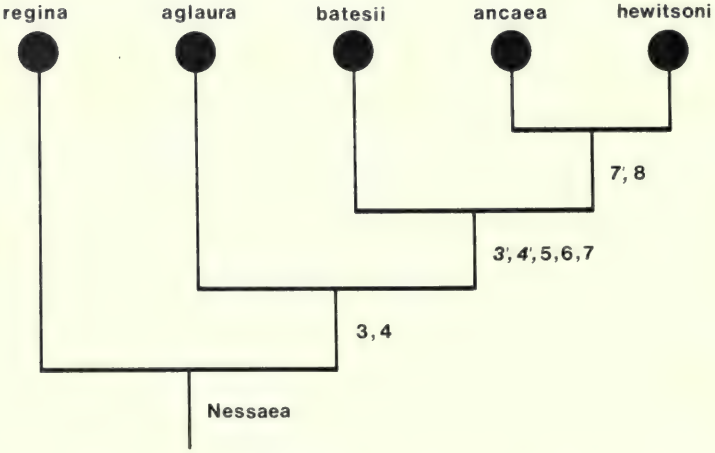


Fig. 29 Character matrix, and cladogram derived from it, for phylogenetic reconstruction of *Nessaea*. In the matrix, A and *A'* denote synapomorphies, and transformations thereof, for characters 3–8 (0 = plesiomorphous condition). These synapomorphies are indicated on the cladogram by the character numbers or number primes. Characters 1–8 are discussed in the text; characters 1 and 2 are postulated to show convergence, and may be linked (for these two characters (a) denotes *a priori* synapomorphous expectations not supported by evidence of rest of matrix).

Although readily separable (see key), I have not been able to recognise any clear-cut autapomorphies for the *Nessaea* species, except *N. hewitsoni* (complete absence of fore wing pre-apical blue spots; blue band on male hind wing).

Derivation of cladogram

Characters 1 and 2 suggest a split of *Nessaea* species into *regina*+*hewitsoni* on the one hand, and *aglaura*+*batesii*+*ancaea* on the other, as sister-groups. However, this is inconsistent with the analysis of characters 3–8, all of which suggest the arrangement adopted, on the grounds of parsimony, in the chosen cladogram (Fig. 29). The synapomorphies of characters 7 and 8 group *ancaea* and *hewitsoni* as sister-species. These two form the sister-group of *batesii* on the evidence of the synapomorphies presented by characters 3, 4, 5, 6 and 7. These three species in turn form the sister-group of *aglaura* on the synapomorphies of characters 3 and 4. All five species are linked by the presumed autapomorphous character of the genus (presence of blue pterobilin pigment in adult).

Data from biometrical survey

Having obtained the cladogram of Fig. 29, the biometric data presented in Table 1 was gathered in the hope that it might either prove consistent with the proposed phylogeny, or reveal obvious inconsistencies. Figs 30–32, summarising the mean values given in Table 1, reveal that the biometric data essentially reflect the phylogenetic sequence proposed (*regina* → *aglaura* → *batesii* → *ancaea* → *hewitsoni*), insofar as no other single sequence of the species would give such orderly trends as those shown. In particular, the alternative hypothesis that *N. hewitsoni* and *regina* form a sister-species pair is not consistent with these data (unless a saltation is involved), whereas the hypothesis that *hewitsoni* and *ancaea* form a sister-species pair gives a 'good fit' to this similarity data.

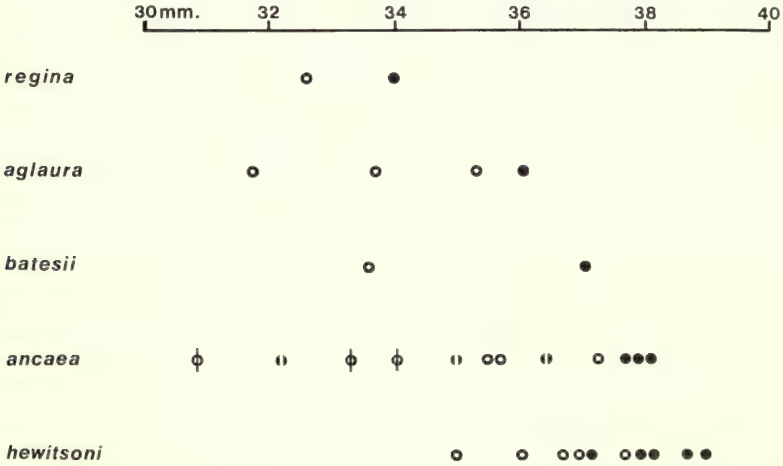


Fig. 30 Mean values of fore wing length from Table 1, plotted in order of proposed phylogenetic sequence of *Nessaea* species (*regina* → *aglaura* → *batesii* → *ancaea* → *hewitsoni*). Solid circles: males. Open circles: females. For *ancaea*, divided symbols represent values for populations allopatric to *hewitsoni*.

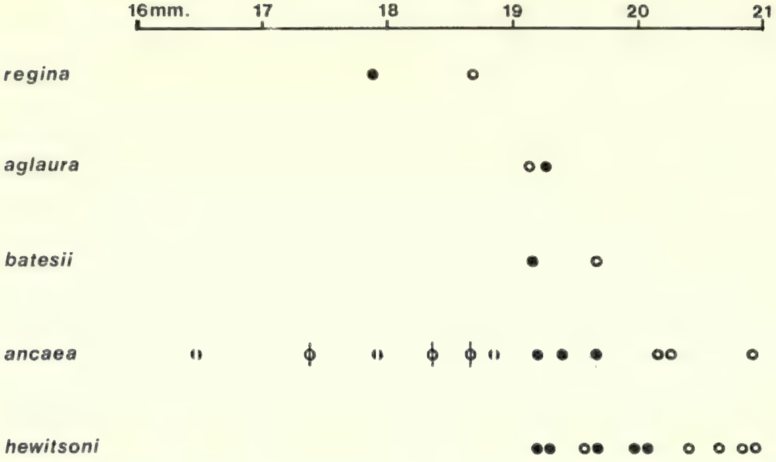


Fig. 31 Mean values of antennal length from Table 1, plotted in order of phylogenetic sequence (as for Fig. 30, including symbols).

Convergence

The acceptance of the cladogram in Fig. 29 suggests that the 'synapomorphies' recorded for characters 1 and 2 are both convergent, and may be correlated. That is, on the hind wing of male *Nessaea* the absence of orange may somehow be linked with the expression of blue externae in cell R_1. The orange of male *N. aglaura* is very reduced, and some individuals show a trace of the externae. No female *Catonephele* or *Nessaea* have orange on the hind wing disc; all female *Nessaea* have the blue externae in hind wing cell R_1. If the loss of orange is genuinely convergent in *hewitsoni* and *regina*, this might suggest some novel ideas about the genetic mechanisms of pattern sex-limitation in butterflies. In this case, the switching off of a male-limited character (orange) may lead to the switching on of an otherwise female-limited character (blue externae).

In *regina*, the two sexes, although not identical, are more similar than in any of the other four

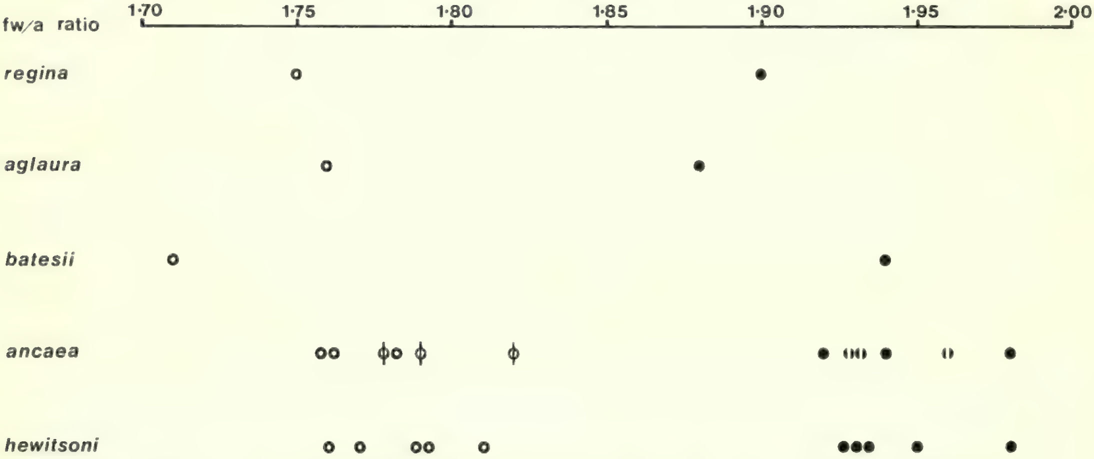


Fig. 32 Mean values of fore wing length/antennal length ratio from Table 1, plotted in order of phylogenetic sequence (as for Fig. 30, including symbols).

Nessaea species, and might represent an example of *male* pattern decoupling (Vane-Wright, 1979; see also p. 51 below). If this possibility is considered, the interpretation of characters 3 and 4 might also be incorrect, as the supposedly plesiomorphous character states of male *regina* would then be secondarily derived (decoupled). This in turn might suggest that *aglaura* was the sister-species of *regina*, rather than the sister-group of (*batesii*+(*ancaea*+*hewitsoni*)). Such a possibility would be consistent with the great similarity of the underside markings of *regina* and *aglaura*, and their distributional relationships (Fig. 28). Professor Keith Brown (pers. comm.) is of the opinion that *regina* and *aglaura* are one species. However, for the present I propose the cladogram of Fig. 29, and suggest that characters 1 and 2 show convergence in *hewitsoni* and *regina*.

Predictions

The species *regina*, *aglaura* and the group (*batesii*+*ancaea*+*hewitsoni*) are allopatric. Within the last named group, the range of *ancaea* broadly encompasses that of the other two, *batesii* being restricted to the eastern part of the zone occupied by *ancaea*, and *hewitsoni* to the western part. The radical change in the signal patterns of male *ancaea* and *hewitsoni*, if we regard them as sister-species, suggests that this pattern difference is connected with a primary isolating mechanism (or specific mate recognition system; Hugh Paterson, in prep.) allowing the two species to coexist. I predict, therefore, that field observations and experiments would reveal differences in epigamic or intrasexual (male–male) interactions mediated through these signals, and that these differences would play a fundamental role in the (prezygotic) reproductive separation of the two species.

The nature of the isolating mechanism between *N. batesii* and *ancaea* is problematic, as it would seem unlikely that the difference in the area of orange would be sufficient. It is interesting to note from Table 1 that, in proportion to size, the antennae of male *batesii* are larger than those of any other *Nessaea* species, departing from the normal trend (Fig. 32). This might suggest that *batesii* has an increased dependence on scent signals, but the difference is slight, and there is no evidence for specialised scent mechanisms in any of the species.

Given that the relationships between the patterns and isolating mechanisms of these species might be worth investigating, a complete matrix of the 20 reciprocal hybridisations possible between all five species could be attempted. From the cladogram, and using the number of branching points between species as an indicator of likely genetic incompatibility, we would expect the ability of the species to hybridise, as measured, for example, by the 'differentiation index' of Ae (1978), to decrease in concordance with the following relationships (assuming isolation between sympatric species is pre-, not post-zygotic):

1 branching	(*hewitonsi* × *ancaea*) >
2 branchings	(*batesii* × *ancaea*; *batesii* × *aglaura*; *batesii* × *hewitsoni*; *aglaura* × *regina*) >
3 branchings	(*aglaura* × *hewitsoni*; *aglaura* × *ancaea*; *batesii* × *regina*) >
4 branchings	(*regina* × *hewitsoni*; *regina* × *ancaea*).

We would thus expect *hewitsoni* × *ancaea* to be the most favourable cross, and (*regina* × *hewitsoni*; *regina* × *ancaea*) to be the least favourable, other crosses being intermediate in success (for a graphic representation, see Fig. 33). But if the suggestion made above concerning *regina* and *aglaura* as possible sister-species is correct, then the hybridisation ranking would alter to the following expectations:

1 branching	(*hewitsoni* × *ancaea*; *regina* × *aglaura*) >
2 branchings	(*batesii* × *ancaea*; *batesii* × *hewitsoni*) >
3 branchings	(*batesii* × *regina*; *batesii* × *aglaura*) >
4 branchings	(*regina* × *ancaea*; *regina* × *hewitsoni*; *aglaura* × *ancaea*; *aglaura* × *hewitsoni*).

These predictions are necessarily simplistic, but any marked deviation from the patterns suggested would call the proposed phylogeny into question.

Pathway models

A pathway model (Vane-Wright, 1979) is an attempt to reconstruct the route or *pathway* by

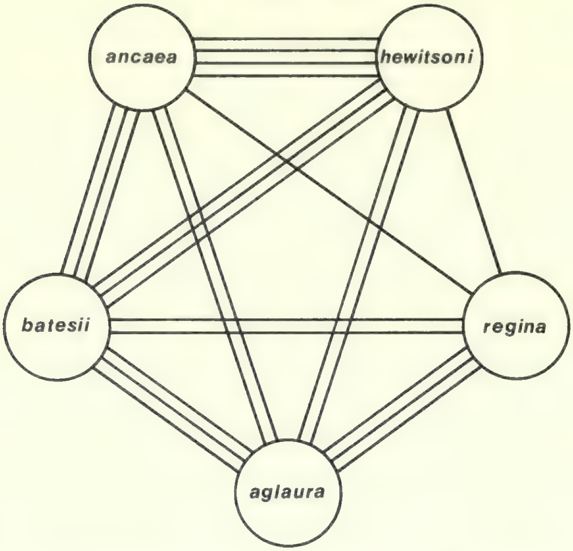


Fig. 33 Graphic representation of predictions concerning hybridisation derived from phylogenetic reconstruction. The number of lines running between each species is directly related to expected hybridisation success.

which the morphism (Vane-Wright, 1975) of a species evolved. Imagine a sexually dimorphic species, with the males white and the females black. If we believe this species to have evolved from a morphism stage in which both sexes were white, we can consider various alternative pathways by which the present white/black morphism could have arisen. In particular, we can address such questions as: did the black females evolve through steadily darkening shades of grey to their present black form, or was there a period of balanced sex-limited polymorphism, with coexistent light and dark females, after which the white females were eliminated?

The purpose of the models is to question critically various such alternatives, to see which models best fit existing information about species and, ideally, to predict as yet unknown facts. Central to this idea is my belief that the 'genetic architecture' of a species, as manifest by dominance relationships, hybrids, chromosome structure, etc., will bear the stamp of its past history, and will be more consonant with one hypothetical pathway than any other. The ultimate goal is to reveal the selection pressures that affect butterfly colour patterns, especially during trans-specific evolution, and how the response of butterflies to these pressures in turn moulds the course of evolution open to them.

The following discussion is based on the system of Vane-Wright (1979), to which the reader is referred for a more complete explanation. Each step in a pathway is set down in the general form $^{C}[x\ (y)\ z]$. In this notation, (x) represents the number of male forms, (z) the number of female forms and (y) the number of shared forms (forms to be found in both sexes). The superscript cipher C indicates the appropriate one of ten morphism classes (1, monomorphism; 2, unimodal polymorphism, where both sexes share the same two or more forms; 3, partial female-limited polymorphism, where there are one or more female-limited forms in addition to the male-like female form(s); 4, partial male-limited polymorphism; 5, partial male/female-limited polymorphism, where there are forms separately limited to both sexes in addition to one or more shared forms; 6, simple sexual dimorphism; 7, multiple female dual polymorphism, where there are two or more female forms none of which is like the single male form; 8, multiple male dual polymorphism; 9, multiple male/female dual polymorphism, where there are two or more forms in both sexes, none of which is shared (classes 1–9 from Vane-Wright, 1975); and 1–6, weak dimorphism, where both sexes exist in a single similar, but not identical form (Vane-Wright, Ackery & Smiles, 1977).

Thus a sexually dimorphic species, as discussed in the example given above, can be notated ^{6}[1 (0) 1]. In addition, the individual morphs can be given lower case letters so that the fate of each can be followed. Thus, in the example given above, the second pathway could be written down as

^{1}[w (w) w]

^{3}[w (w) w b]

^{6}[w (0) b]

where (w) represents the white form, and (b) the black form.

Particular interest is given to weakly dimorphic species, which are of widespread occurrence in butterflies. In general, they may either represent the first stages in the evolution of marked sexual dimorphism, or its collapse. The latter is envisaged as an example of the phenomenon of *decoupling* (Vane-Wright, 1979). This occurs when a morph is sex-limited for one or more steps in a pathway, and is only subsequently introduced into the other sex. Such a morph is said to be a decoupled morph, and is notated in the corresponding lower case italic. If, for example, our white/black dimorph species were to evolve a stage further by the re-introduction of a white female morph, this would be shown in the following fashion:

^{6}[w (0) b]

^{3}[w (0) *w* b]

(*w*) being the decoupled white female morph. As the (w) and (*w*) morphs, even if controlled by identical major genes, are separately introduced, one into a sex-limited pattern system, my expectation is that their expression will not be identical. With the elimination of the black female morph, the pathway can be extended to

$^{1-6}$[w (1) *w*]

representing a weakly dimorphic species evolved through decoupling. Although such a process has yet to be demonstrated, it is my belief that the weakly dimorphic state of *Papilio dardanus* in Madagascar, the Comoros and Somalia, represents independent evolution of the male-like female form through a process of decoupling (Vane-Wright, in preparation).

Where a morph evolves steadily, without polymorphism, from one form to another, this is notated in the following manner:

^{1}[w (w) w]

↓

^{6}[w (0) w′]

In our original example, if $w' = b$, then this would represent the steady evolution of the black female form through intermediate stages of grey.

We may recognise three basic morphs within the genus *Nessaea.*

(a) The female morph. Hind wings brown, with blue externae in cell R_1, no orange. This occurs in the females of all five species, and in the male of *regina*, where it might represent a decoupled morph, (*a*).

(b) The orange male morph. Hind wing black, with orange patch, no blue externae. This occurs in the males of *aglaura*, *batesii* and *ancaea.*

(c) The blue male morph. Hind wing black, with blue band and externae, no orange. This occurs only in *hewitsoni.*

As the female morph (a) is constant for all species, we may take that as original and unchanging for the genus. As orange banded males are general for *Catonephele* species, we may take the orange male morph (b) as basic for the male of the genus. This gives the original morphism of *Nessaea* as ^{6}[b (0) a].

The *regina* pathway. The simplest polymorphic pathway for the evolution of the *regina* morphism assumes that the male pattern of this species is decoupled:

$$T_1 \quad {}^{6}[\mathrm{b}\ (0)\ \mathrm{a}]$$

$$T_2 \quad {}^{4}[\mathit{a}\ \mathrm{b}\ (\mathrm{a})\ \mathrm{a}]$$

$$T_3 \quad {}^{1-6}[\mathit{a}\ (\mathrm{a})\ \mathrm{a}]$$

Alternatively, the shift from (b) to (a) morph in the male might have been achieved through directional selection alone. If hybridisation of *regina* × *aglaura* is possible, on the first (balanced polymorphism) hypothesis we might expect male (*a*) to be dominant to (b) (i.e. male F_1 hybrids to look like *regina*). This expectation follows because (*a*) would have been introduced with (b) already present, and the two coexisted for some time (see, for example, Sheppard, 1958; Murray, 1972; and Berry, 1977, on the evolution of dominance under disruptive selection). On the second hypothesis ($6 \rightarrow 1\text{–}6$ pathway), we might expect F_1 male hybrids to be intermediate, with some penetrance of orange. Unfortunately, such simplistic predictions are not very likely to be accurate! In this context it is interesting to note the apparent existence of non-orange *aglaura* males ('margaretha' Krüger; see p. 36), which gives some credence to the idea that one or other of these two pathway models may be correct. However, within *aglaura*, should orange prove dominant to non-orange, this would cast doubt on the postulated basic ${}^{6}[\mathrm{b}\ (0)\ \mathrm{a}]$ morphism.

The *aglaura*, *batesii* and *ancaea* pathways. These species all retain the (b) morph in the male, but modified in each case apparently by directional selection ($6 \rightarrow 6$ pathways). Whether or not one of the three male forms corresponds closely to the original condition of the male pattern for the group cannot be considered on present data.

The *hewitsoni* pathway. The male pattern of *hewitsoni* could also have arisen by directional selection:

$$T_1 \quad {}^{6}[\mathrm{b}\ (0)\ \mathrm{a}]$$

$$T_2 \quad {}^{6}[\mathrm{b}'\ (0)\ \mathrm{a}]$$

where (b′) = (c). But the difference between the (b) and (c) patterns is so sharp, and taken with the concept of *ancaea* and *hewitsoni* being sister-species, it suggests that (c) might have arisen through disruptive selection and a 6 : 8 : 6 pathway:

$$T_1 \quad {}^{6}[\mathrm{b}\ (0)\ \mathrm{a}]$$

$$T_2 \quad {}^{8}[\mathrm{b}\ \mathrm{c}\ (0)\ \mathrm{a}]$$

$$T_3 \quad {}^{6}[\mathrm{c}\ (0)\ \mathrm{a}]$$

This pathway involves a period of balanced male polymorphism (T_2, class 8 stage), as does the 6 : 4 : 1–6 pathway above for *regina* (T_2, class 4 stage). As male polymorphism is very rare in butterflies, I have argued elsewhere that such pathways must be considered unlikely on present evidence (Vane-Wright, 1979). However, it is possible that transient polymorphism in males does occur, with the rapid fixation of one morph. *Euthalia monina monina* (Fabricius) (Bernardi, 1974; Fleming, 1975 : pl. 46, p. 50) is an extraordinary example of a class 8 morphism of the type ${}^{8}[\mathrm{q\ r\ s}\ (0)\ \mathrm{p}]$, and might represent such an evolutionary stage. If hybridisation of *ancaea* × *hewitsoni* produced F_1 males essentially *hewitsoni*-like in appearance, this would favour the acceptance of the 6 : 8 : 6 pathway model for the evolution of *hewitsoni*, as the coexistence of the old (b) and new (c) morphs at T_2 would tend to result in the dominance of (c) over (b). However, Professor Keith Brown has sent me a photograph (Figs 23, 24) of an almost undoubted *ancaea* × *hewitsoni* hybrid from São Paulo de Olivença, Brazil (specimen in MNRJ). This is a remarkable intermediate male, with slightly reduced orange and blue markings on the hind wing upperside, and otherwise predictably identical to both species. This is inconsistent, in my view, with any protracted period of male-limited polymorphism in the evolution of *hewitsoni*.

Speciation

N. regina, *aglaura* and the *ancaea*-group (*batesii*, *ancaea* and *hewitsoni*) form three strictly allopatric (not parapatric) assemblages, occurring in N. Venezuela, Central America–west Andes, and east Andes–Amazon basin–Guiana shield, respectively. Within the *ancaea*-group, *batesii* and *hewitsoni* are also allopatric, but *ancaea* practically covers the whole range of the two, including the otherwise unoccupied middle Amazon (Fig. 28).

According to the phylogenetic hypothesis (Fig. 29), *ancaea* and *hewitsoni* form a sister-species pair. From this it is predicted (p. 49) that the simple but striking difference between the male patterns of the two species is connected with a primary isolating mechanism. If these species originated through geographic (allopatric) speciation, then we might expect that any functional differences found between *ancaea* and *hewitsoni* where they do not coexist, would be exaggerated where they do (character displacement: Brown & Wilson, 1956).

The only information we have relevant to such a proposition is the data on size (Table 1), which could be related to differences in ecological 'strategy' (e.g. *r* versus *K* strategies, Southwood, 1976; host-plant shifts, etc.). As is clearly revealed by Figs 31 and 32, however, *ancaea* and *hewitsoni* are virtually *identical* in size where they coexist, despite the fact that where *ancaea* is allopatric it is markedly smaller, apparently including the smallest insects in the genus. These very small *ancaea* occur in the Guiana shield, where they are sympatric with the rather larger *batesii*. It could, therefore, be argued that this merely represents a character displacement with respect to *batesii*. The latter idea can be disposed of, with respect to *hewitsoni*, by the observation that on the middle Amazon, where *ancaea* exists in isolation, the individuals are of intermediate size, but still smaller than *hewitsoni*.

MacArthur & Wilson (1967 : 159) point out that character displacement is not universal ('in many cases no divergence is known to occur, and in a few there is actually a convergence of the two species in some characters'). More recently, Grant (1972) has indicated that many apparent examples of ecological character displacement can be explained on other grounds. As always in such situations, new data or hypotheses may call into question the old. If the size variation of *Nessaea ancaea* in relation to *hewitsoni* had been studied previously, the situation in upper Amazon populations might well have been regarded as 'a convergence'. 'Convergence' can only make sense by invoking some stage of separation. In relation to a sister-species pair and character displacement, this can only mean geographical separation. Thus such ideas of convergence would be based on a covert allopatric speciation model. If we reject this model, which for the *ancaea*/*hewitsoni* species pair has no current evidence in its favour, we can see the relationships between sympatric *ancaea* and *hewitsoni* as consistent with a sympatric speciation model, with no concomitant shift in size. In my view we may expect a considerable number of broadly comparable cases to come to light as phylogenetic work on the butterflies proceeds (e.g. *Mycalesis durga*/*drusillodes*, Vane-Wright, 1971; ? *Hypolimnas bolina*/*misippus*, Vane-Wright, Ackery & Smiles, 1977; *Papilio phorcas*/*dardanus*, Vane-Wright, in preparation; see also Vane-Wright, 1978).

Thus 'character convergence' may in some cases be illusory: such situations may reflect non-divergence of certain features during sympatric speciation. But if so, it then remains to demonstrate what ecological shifts, if any, are needed to allow such sister-species pairs to coexist (cf. Hutchinson, 1975 : 497). This in turn could be related to questions of whether or not behavioural shifts cause speciation in the first place (Vane-Wright, 1978). Only field and experimental work will enable us to choose between various alternatives.

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Clothes-moths of the *Tinea pellionella* complex: a revision of the world's species (Lepidoptera: Tineidae)

Gaden S. Robinson

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Clothes-moths of the *Tinea pellionella* complex: a revision of the world's species (Lepidoptera : Tineidae)

Gaden S. Robinson

Department of Entomology, British Museum (Natural History), Cromwell Road, London SW7 5BD

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Synopsis

This paper gives an account of the eleven species of the *Tinea pellionella* complex, the case-making clothes-moths. One species is described as new. Nine new specific synonyms are established. Keys and figures for the identification of male and female specimens are given and special reference is made to intraspecific variation. The biology and distribution of each species is discussed in detail with special reference to damage, pest status and the factors limiting distribution. An extensive review of all literature including literature on control is provided: the bibliography contains 360 references. Records of outbreaks of introduced species and records of quarantine interceptions are given: distribution maps are provided.

Introduction

'The Motte bredethe amonge clothes till that they have byten it asonder; it is a maniable worm yet it hydeth him in y clothe that it can scantly be sene; it bredeth gladly in clothes that have ben i[n] an evyll ayre or in a rayn or myst & so layde up without hanging in the sonne or other swete ayre after. The [h]erbes that be bitter and well smelli[n]ge is good to be layde amo[n]ge suche clothes, [such] as the baielevis [or] cipreswode.'

(Anonymous, 1521)

Five Biblical references in which the clothes-moth appears in the context of simile or metaphor attest to the antiquity of man's awareness of – and opposition to – a ubiquitous group of pest species. Apart from appearances as a literary device (Job **14**: 2, Isaiah **50**: 9, **51**: 8, Matthew **6**: 19, James **5**: 2) the clothes-moth was described in some detail by Plinius Secundus (Historia Naturalis **11**: 41) in about A.D. 77 and, in one of the first printed books, Joannes de Cuba (1491) describes 'Tynea' and provides a woodcut (republished by Hartnack, 1939) of a woman brushing

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larvae and frass from moth-eaten garments. A pirated version of Cuba's woodcut accompanies the earliest printed English account of the clothes-moth, quoted above.

Recognition of different 'Tynea' was not slow in evolving. Réaumur (1737) differentiated between the tapestry-moths (*Trichophaga* spp.) – which have free-living larvae – and the case-making species. Linnaeus (1758) described the common European tapestry-moth as *Phalaena* (*Tinea*) *tapetzella* and the case-maker as *Phalaena* (*Tinea*) *pellionella* – his *Phalaena* (*Tinea*) *vestianella* is not a clothes-moth as was shown recently by Sattler & Tremewan (1978). Linnaeus apparently did not recognize the webbing clothes-moth (also with a free-living larva) and it was not for a further eighty years, until the publication of a detailed review of the problem by Zeller (1838), drawing heavily on Réaumur's observations, that the separation of tapestry-moths (*Trichophaga*), webbing clothes-moths (*Tineola*) and the case-making clothes-moths (*Tinea*) was unequivocally established. The realization that '*Tinea pellionella*', the case-making clothes-moth, was really a complex of several species was gradual rather than sudden. Haworth recognized *flavescentella* as distinct from *pellionella* in 1828 and by 1860 *murariella* and *dubiella* had also been described. However, close similarities between the species of the *pellionella*-group had already caused a good deal of confusion and were to cause much more. Stainton (1874) reneged on his recognition of *dubiella* in precisely the same way as Müller-Rutz did some fifty-eight years later in deciding there was no genitalic difference between *turicensis* and *pellionella*; as it transpired, both were wrong. Improved optical equipment and dissection techniques permitted Pierce & Metcalfe (1934) to separate the tangle of specific identities known as '*flavescentella*' and (earlier) '*merdella*'. A review of the Palaearctic Tineidae by Petersen (1957) was closely followed by a volume of *Fauna SSSR* on the Tineinae (Zagulajev, 1960). However, even these last two works contained enough misidentifications to hamper seriously anyone using them (Petersen corrected many of these in a subsequent series of papers) and, being regional monographs, they were incomplete. Until a translation of Zagulajev's (1960) work was published (1975), no modern taxonomic work dealing with the species of the *pellionella*-group was available in English. Regrettably, the degree of accuracy of this translation is not high and large parts of the descriptions of at least two *pellionella*-group species have been omitted.

This paper is a revision of the case-making (or 'case-bearing') clothes-moths of the *Tinea pellionella* group. It does not include *Tinea pallescentella* Stainton nor *Tinea columbariella* Wocke for although both of these species have case-making larvae (*pallescentella* only makes a case when it is about to moult and leaves it when its new integument is hardened) they are not members of the *pellionella*-group. *Tinea pallescentella* was not collected in Europe until after 1840 and is now known from Patagonia, the U.S.A., Europe and New Zealand. Its appearance in western Europe coincided with the peak of the trade in salted sheepskins imported from Patagonia and I consider it to be a Patagonian species which has become established in Europe during the last 140 years. The taxonomic affinities of *pallescentella* are with Neotropical rather than Palaearctic species. Descriptions of *pallescentella* and *columbariella* (a species usually associated with birds' nests and rarely a pest) are given by Petersen (1969) and Zagulajev (1960) (the latter author misidentified *pallescentella* as *coacticella* Zagulajev). Only a few other species of Tineidae with case-making larvae are occasionally found associated with woollen or feather products – these are free-living *Monopis* species and their larval 'cases' are not true cases but immovable sections of tunnel, the walls of which consist predominantly of frass and food particles.

The eleven species of the *pellionella*-group described here correspond to the subgenus *Tinea* (as defined by Zagulajev – 1960 – in his classification of the Tineinae of the U.S.S.R.). However, several more species are included here and *Tinea pallescentella* (included by Zagulajev as *coacticella*) is excluded. The *pellionella*-group as here defined should not be interpreted as a subgenus although I consider it to be a monophyletic group. Six of the constituent species are known to be pests but the other five are rare and are not known to cause 'domestic' damage.

The identification of members of the *pellionella*-group is not possible without careful dissection of the genitalia of either sex. Although *steueri* may be recognized by its hyaline spot at the base of the fore wing, the remaining species are remarkably similar in appearance. The separation of females of *translucens* and *murariella* is difficult and one cannot expect to identify all specimens with certainty. A good stereoscopic microscope with a linear magnification range to at least

×50 is required for dissection and a good single-objective microscope with a magnification of up to ×500 is required for the subsequent examination of preparations. The use of phase-contrast in the examination of certain specimens may be helpful.

In preparing this revision I have relied heavily upon specimens in the BMNH collection and, unless otherwise stated, all material examined is from that institution. In addition to approximately 950 specimens in BMNH, all *pellionella*-group specimens in NMNH, Washington (about 60 specimens) have been examined. Palaearctic material from many European institutions has been examined and published upon by Dr G. Petersen in a series of papers from 1959 to 1973. Specimens from the Ethiopian region have been assiduously searched out and published upon by Dr L. A. Gozmány (see Gozmány & Vári, 1973). It has therefore been possible to be unusually selective in choosing material for examination or re-examination.

The bibliography is intended to provide a practically complete listing of citations for all species. *Tinea pellionella*, however, is recorded in practically every local list ever published in Europe and it has also been misidentified by many workers. Local check-lists which, of the *pellionella*-group species, list only *pellionella* and are of little or no interest have been omitted from the bibliography in order to keep it to a manageable length. Each reference is followed by square brackets containing details of the contents of the cited work: absence of these details indicates that the item is of minimal interest. Where a geographical record is provided, the region involved is given, e.g. [Dalmatia].

Beneath each species heading, the valid name and its synonyms are given in chronological order of description with dates, reference to the original description and with the data and depository of the primary type or syntype series. This is followed by listings of subsequent literature citations of the valid name and of synonyms, again in the order of date of the original descriptions. Misidentifications are then listed (in square brackets) in sequence of date of their first occurrence.

Size measurements given are the wing span of a specimen set in conventional fashion.

The terminology used in descriptions of male and female genitalia follows Klots (1956) (see also 'Preparatory Techniques').

Low-power drawings were made using a camera lucida on a Wild M5 microscope. The scale lines on all these drawings are of 1 mm. High-power drawings of the apex of the aedeagus (Figs 14–27) and anellus spines (Figs 28–42) were made with a drawing attachment on a Wild M20 microscope and these drawings have scale lines of 0·1 mm. The number given in a smaller typeface on each drawing is the number of the wing or genitalia slide from which the drawing was made.

Preparatory techniques

Methods used for the preparation of genitalia slides are described elsewhere (Robinson, 1976*b*) and little modification of the techniques described in that paper is necessary in dealing with species of the *pellionella*-group. It is necessary, in the case of males, to protrude the aedeagus by holding it at the base and pushing it towards the uncus. This manoeuvre everts the anellus and exposes the anellus spines without entangling them with the tip of the aedeagus. The aedeagus may then be removed by holding it just below the apex and gently and carefully pulling it posteriorly. Removal of the aedeagus in an anterior direction results in damage to the anellus and the obscuring of details at the tip of the aedeagus by the anellus spines (see 'Morphology'): preparations made in this way are extremely difficult to examine satisfactorily or to identify without the use of phase-contrast microscopy. The male genital armature is laterally compressed and difficult to mount in a dorsoventral position. The uncus, gnathos and anellus spines are best examined in lateral view and the preparations for this work were therefore mounted with the left valve folded down towards the saccus, the genital armature in lateral (Fig. 13) or three-quarter view with the aedeagus removed and mounted separately.

The female genitalia must be removed from the abdomen and the contents of the corpus and ductus bursae removed before adequate examination can be carried out.

Chlorazol Black E or mercurochrome was used for staining preparations and Euparal was employed as a mounting medium.

Abbreviations

BMNH	British Museum (Natural History), London, U.K.
IP	Institut für Pflanzenschutzforschung, Eberswalde, East Germany.
MAK	Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, West Germany.
MARC	Mt Albert Research Centre, Auckland, New Zealand.
MNHN	Muséum National d'Histoire Naturelle, Paris, France.
MNHU	Museum für Naturkunde der Humboldt-Universität, Berlin, East Germany.
MRAC	Musée Royal de l'Afrique Centrale, Tervuren, Belgium.
MZU	Museum of Zoology of the University, Oulu, Finland.
NM	Naturhistorisches Museum, Basle, Switzerland and Vienna, Austria.
NMNH	National Museum of Natural History, Washington, D.C., U.S.A.
P.	Slide number prefix for Pierce slide collection, BMNH.
Pet.	Slide number prefix for preparation by G. Petersen.
TM	Természettudományi Múzeum, Budapest, Hungary.
UM	University Museum, Oxford, U.K.
UOP	University of Osaka Prefecture, Osaka, Japan.
UZI	Universitetets Zoologiska Institution, Lund, Sweden.
ZI	Zoological Institute, Academy of Sciences, Leningrad, U.S.S.R.
ZMU	Zoological Museum of the University, Helsinki, Finland.

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The photographs of moths, larval cases and pupae (Figs 82–103) were produced by the Photographic Unit, BMNH.

Check-list of the species of the *Tinea pellionella* group

Tinea Linnaeus, 1758
    Autoses Hübner, [1825]
    Dystinea Börner, 1925

flavescentella Haworth, 1828
    *_tristigmatella_ Costa, [1836]
roesleri Gozmány, 1969
pellionella Linnaeus, 1758
    *_zoolegella_ (Scopoli), 1763
    *_albella_ Costa, [1836], nom. praeocc.
    demiurga Meyrick, 1920, **syn. n.**
    gerasimovi Zagulajev, 1978, **syn. n.**
translucens Meyrick, 1917
    metonella Pierce & Metcalfe, 1934, **syn. n.**
    *_leonhardi_ Petersen, 1957, **syn. n.**
    margaritacea Gozmány, 1967, **syn. n.**
    fortificata Gozmány, 1968, **syn. n.**
murariella Staudinger, 1859
    bipunctella (Ragonot), 1874

lanella Pierce & Metcalfe, 1934
messalina **sp. n.**
dubiella Stainton, 1859
  turicensis Müller-Rutz, 1920, **syn. n.**
  bispinella Zagulajev, 1960, **syn. n.**
  tenerifi Zagulajev, 1966, **syn. n.**
steueri Petersen, 1966
bothniella Svensson, 1953
  sibiriella Zagulajev, 1960
  unidentella Zagulajev, 1960
hongorella Zagulajev, 1975

* primary type or syntype not examined.

Geographical distribution

I consider the *Tinea pellionella* group to be of Old World origin, its present-day species originating in the northern hemisphere with the exception of *roesleri* which is an endemic Ethiopian species closely related to *flavescentella*. The distribution of many of the members of the *pellionella*-group has been and is being modified, not only by the transport of specimens by man (e.g. *dubiella* and *pellionella* to Australia and New Zealand, *murariella* to the neotropics) but also by alteration of their environment. The spread of central heating in buildings in temperate western Europe has apparently resulted in the decline of *pellionella* as a pest while a species less resistant to cold (*translucens*) has been able to colonize this new 'tropical' environment, albeit in sporadic outbreaks as a result of importation (see below).

Distribution maps are given for the commoner species of the *pellionella*-group (Figs 76–81) and it will be seen that distributions range from Palaearctic-Subarctic (*bothniella*) and Palaearctic–European–Mediterranean (*flavescentella*) to practically cosmopolitan (*dubiella, translucens, pellionella*). Maps are not given for species known only from one or two localities.

Geographic variation of a minor nature has been noted in *translucens* (minor differences between Japanese specimens and those from other localities) and in *flavescentella* (minor differences in two male specimens from Spain and North Africa) – see the descriptions for these species. In *translucens* variation is restricted to the male.

A paucity of records of the *pellionella*-group from the New World and the Indo-Pacific region may be attributable to under-collection. The Neotropical region has, however, a rich tineine fauna and niches for keratin-feeders may already be filled by species other than those of the *pellionella*-group. *Tinea pallescentella*, considered to be originally a Neotropical species which has recently colonized other regions and fills a *pellionella*-group niche, has a number of relatives which, with *pallescentella*, may form the Neotropical equivalent of the *pellionella*-group; a small group of endemic *Tinea* species with Neotropic affinities is also present in the Nearctic region and this too may block the spread of *pellionella*-group colonizers.

Morphology

The morphology of the structures used in identification of the *pellionella*-group is unremarkable with the exception of that of the aedeagus which has misled a number of authors. The aedeagus lies, after maceration, in an invaginated membranous tube – the anellus. Manoeuvring the tip of the aedeagus towards the uncus, the anellus may be evaginated to expose the pair of lateral bands of anellus spines (Fig. 13) which, when the aedeagus is retracted, overlie the tip of the aedeagus. The aedeagus is tubular and sclerotized to the tip but the sclerotization may continue in a short 'tongue' which may be invaginated with the vesica (this is shown in Fig. 17). The apical or subapical sclerotized wall of the aedeagus may have thorn-like projections (e.g. *pellionella*), spines (e.g. *flavescentella*) or comb-shaped projections (*lanella*). These sclerotized projections, continuous with the sclerotized wall of the aedeagus, are carinae (see Klots, 1956) and are not to be confused with sclerotized attachments to the unsclerotized membrane of the vesica which are cornuti. Cornuti are either inside or projecting from the tip of the aedeagus – unless the vesica is partially or wholly everted. Examination of copulas has shown that in the *pellionella*-group the vesica is only slightly everted to the degree shown in Figs 19, 24 and 25. Several authors (e.g. Petersen, 1966; Gozmány & Vári, 1973) have confused anellus spines, carinae and cornuti and subsequent identification from their drawings or descriptions is extremely difficult.

In the case of *Tinea translucens*, the group of needle-like apical cornuti may arise from a membranous surround (Fig. 18) or from a sclerotized extension of the aedeagus wall (Figs 19, 20) and this individual variation makes it impossible to label unequivocally the apical spines as either cornuti or carinae in this species. They are here referred to as the former but no significance should be attached to this choice of term.

In the figures of the aedeagus given here (Figs 14–27) the membrane of the vesica is not shown within the aedeagus and the figures should be interpreted with the description of the male genitalia.

Variation in venation, valva shape, length of aedeagus and saccus and in the number of signa is discussed in some detail below (see 'Remarks' for the *Tinea pellionella* group).

TINEA Linnaeus

Tinea Linnaeus, 1758, *Syst. Nat.* (edn 10) **1** : 496. Type-species: *Phalaena* (*Tinea*) *pellionella* L., 1758, *ibidem* **1** : 536, by subsequent designation by ICZN, 1957, *Opin. Decl. int. Comm. zool. Nom.* **15** : 254.

Autoses Hübner, [1825], *Verz. bekannter Schmett.* : 401. Type-species: *Phalaena* (*Tinea*) *pellionella* L., 1758, *Syst. Nat.* (edn 10) **1** : 536, by subsequent designation by Fletcher, 1929, *Mem. Dep. Agric. India, Ent. Ser.* **11** : 29.

Dystinea Börner, 1925, *in* Brohmer, *Fauna Dtl.* (edn 3) : 372. Type-species: *Phalaena* (*Tinea*) *pellionella* L., 1758, *Syst. Nat.* (edn 10) **1** : 536, by original designation.

As currently constituted, the cosmopolitan genus *Tinea* contains over 400 nominal species, many of which are not Tineinae. It is therefore impracticable to give a generic diagnosis which defines the limits of the genus.

The *pellionella*-group

♂, ♀. 8–17 mm. Head with conspicuous pair of large tufts of elongate scales forming rosettes behind eyes and extending forward to vertex; frons with more diffuse pair of similar tufts; scale insertions extending anteriorly from base of antenna to a third pair of tufts just posterior to tentorial pits. Pilifers short, stout, clothed with elongate dark bristles. Maxillary palpus five-segmented, clothed with closely appressed pale scales, reaching to between middle of second segment of labial palpus and middle of third segment. Fourth segment of maxillary palpus elongate, at least twice length of any other segment; fifth segment shortest, one-quarter or less length of fourth segment. Labial palpus three-segmented, length of first, second and third segments approximately in proportion 3 : 5 : 4. Second segment of labial palpus with line of rough, protuberant scales on ventral surface and with ventral row of about ten elongate dark bristles; outer side of second segment with similar but more sparse row of six or seven bristles; apex of second segment with half-rosette of eight to ten bristles on outer side. Galea short, not reaching tip of first segment of labial palpus (*flavescentella* and perhaps *roesleri*) or twice that length, reaching middle of second segment. Antenna filiform, scape with pecten of eight to ten deciduous bristles, pedicel slightly swollen. Segments of flagellum short, cylindrical or barrel-shaped, finely ciliate, cilia not as long as segment diameter; each segment clothed with closely appressed elongate scales. Fore wing elongate, ovate (Figs 3–7) with complete venation (Fig. 3) or venation modified by stalking (Figs 4–7) or development of M_4 (Fig. 7 – see also *hongorella*). Venation variable (especially in position of branching of veins from cell – compare Fig. 5 with 6), both within and between species. Fore wing yellowish or brownish with characteristic pattern of three dark dots, discocellular, discal and plical (absent or ill-defined in *bothniella* and *hongorella*). Hind wing venation complete but variable within and between species particularly with respect to configuration at end of cell (Figs 8–12). Female with two frenulum bristles. Hind wing glossy, pale greyish or ochreous.

GENITALIA ♂ (Fig. 13). Saccus narrow, elongate. Valva triangular to rectangular, apex rounded or truncated at costal margin, shape variable within and between species; valva without protruding lobes or processes of any kind (Figs 43–49). Juxta roughly hexagonal, usually only lightly sclerotized, sclerotization continuous with vinculum. Gnathos tapered, directed postero-ventrad, tips more or less upturned towards uncus, shape of dorsal margin varying from straight to concave both within and between species. Uncus stout, tapered, turned slightly ventrad (markedly hooked ventrad in *steueri* and *bothniella*) and with a distinctive small notch in the tip. Anellus with band of heavily sclerotized spines at either side of aedeagus, spines strongly developed closest to vinculum and becoming smaller and less heavily sclerotized towards tip of anellus; distal to smallest spines, band usually still visible as row of progressively weaker sclerotized plaques. Anellus spines, usually numbering about 20, arranged in a band three or four spines wide but spines sparse in *lanella* and very large and arranged in single line in *bothniella* and *steueri*. Aedeagus cylindrical, straight or slightly curved, with minute thorn-like carinae just below apex (*pellionella*, *hongorella*), with spine-like carinae at apex (*flavescentella*, *roesleri*), with a serrated, comb-shaped pair of carinae below apex (*lanella*) or without carinae. Vesica with a single small (*flavescentella*) or large (*bothniella*) cornutus, without cornuti (*hongorella*, *steueri*), or with a pair of elongate blade-shaped cornuti which may be substantially reduced (*dubiella*) and may be accompanied by smaller cornuti (*translucens*, *messalina*).

Genitalia ♀. Eighth sternite with deep medial emargination accommodating ostium. Antrum swollen posteriorly, inner wall with or without transverse folds or dish-shaped protuberances (*dubiella*). Anterior region of antrum with or without (*steueri*) pair of more or less heavily sclerotized lateral longitudinal folds which may be transversely divided into two sections with differing degrees of sclerotization and membrane thickness and hence different staining properties. Some species with pattern of annular sclerotization at posterior end of ductus bursae, adjacent to antrum, appearing as fine, dark transverse stripes. Inception of ductus seminalis dorsal, immediately anterior to antrum and to any annular sclerotization. Corpus bursae with one to six signa. Signa needle-like, each set in nodular, pyramidal or short and blade-shaped sclerotized base which may, in turn, lie in large circular sclerotized field hereafter referred to as the 'signum base-plate'. Signa in equatorial or anterior position on wall of corpus bursae.

Remarks. A number of characters have, during this study, been found to be subject to marked intraspecific variation. Zagulajev (1960) has laid much stress upon venational characteristics and has used these extensively in his key to the species of *Tinea* occurring in the U.S.S.R. As in the Tinissinae (Robinson, 1976*a*), the venation of the *pellionella*-group was found to be markedly unstable. The fore wing shows particular instability (Figs 3–7) with respect to the separation or otherwise of R_4 and R_5, the comparative distance between the bases of R_1 and R_2 and R_2 and R_3, the configuration of the discocellular cross-vein and the bases of the veins which arise from it. The degree of development of the discal chorda, *M* in the cell and of *CuP* are also variable. In the hind wing (Figs 8–12) the configuration of the discocellular cross-vein and attached vein-bases is variable as is the degree of development of *M* and *CuP*. The position of the tip of M_1 in relation to the wing apex is not of significance at species level as suggested by Zagulajev (1960). The development of 'extra' veins is by no means rare; a supernumerary vein may be present as a result of forking of *Rs* (Fig. 11) or by the addition of a medial branch (M_4) in the fore wing as in the holotype of *Tinea hongorella* (q.v.) or the specimen of *Tinea translucens* in Fig. 11.

I have been unable to find venational characteristics which serve to differentiate between the species of the *pellionella*-group recognized here. It is noteworthy that Zagulajev's key (based on external characteristics and placing heavy reliance on venation) for the separation of the species of *Tinea* found in the U.S.S.R. (1960 : 144) contains two pairs of misidentifications, each pair representing the opposite sexes of one species. These pairs are *leonhardi*+*turicensis* (= *translucens*) and *unidentella*+*sibiriella* (= *bothniella*). The first pair is separated by venational characteristics, the second pair by the length of the maxillary palpi; the second pair is later (p. 172) differentiated by venation. Within the *pellionella*-group the length of the maxillary palpi does not differ consistently between species. In *steueri* and *bothniella*, however, the palpi *may* be longer than in the other species but more material is needed before this can be verified. There appears to be no difference in the length of the maxillary palpi of the opposite sexes of the same species.

Zagulajev (1960 : 146) has used the ratio of aedeagus length to saccus length and also the ratio of the length of the aedeagus to that of the valva as key characters. The shape of the valva varies considerably both within and between species of the *pellionella*-group (Figs 43–49) and does not appear to offer any greater stability in length than the saccus; in addition it is difficult to measure the length of the valva with any degree of accuracy. I have taken graticule measurements of the aedeagus and saccus length of each undamaged male genital armature examined, a total of 160 pairs of measurements. A scatter diagram (Fig. 1) of the measurements shows there to be much

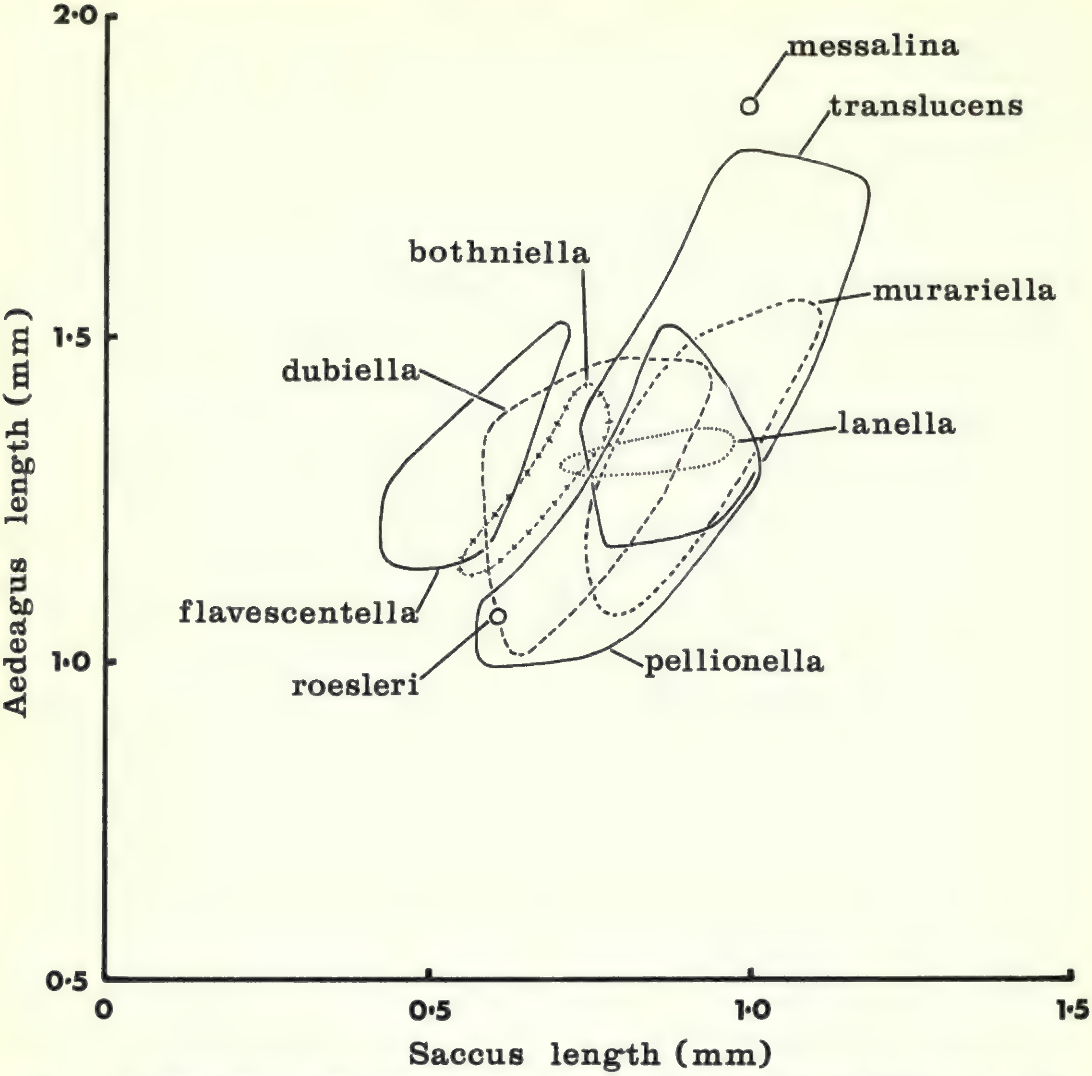

Fig. 1 Outlines of scatter diagrams of aedeagus length plotted against saccus length for nine species of *Tinea*. Number of points plotted for each species – *flavescentella*, 15; *roesleri*, 1; *pellionella*, 59; *translucens*, 35; *murariella*, 12; *lanella*, 3; *messalina*, 1; *dubiella*, 28; *bothniella*, 4. (Original data are available from the author on request.)

overlap of all species [measurements from *steueri* and *hongorella* are not included – but see the description of the male genitalia of these species] with the exception of *flavescentella* (short saccus) and *messalina* (long aedeagus). *Tinea dubiella* and *bothniella* fill the gap in saccus size between *flavescentella* and the rest of the species here considered. The means and 95% confidence limits for aedeagus and saccus length and the ratio of the two are given in the description of the ♂ genitalia of each species.

Intraspecific variation occurs also in the shape of the valva, notably in its size, the degree of concavity of the costa and the degree of truncation at the costal side of the apex (Figs 43–49).

In the female genitalia, the most pronounced variation occurs in the number of signa (Fig. 2). Variation may be extreme and common (*pellionella* has from two to five signa) or may never occur (all specimens of *translucens* examined were found to have two signa) or may be of an intermediate nature (*flavescentella* usually has four signa but may very occasionally have two or three).

Some slight variation may occur in the size and location of signa in all species but the greatest range of variation occurs in *pellionella* in which a 'basic complement' of two signa is augmented by up to three further signa which may be considerably smaller than the 'basic' pair and may not be set in sclerotized base-plates. Minor variation also occurs in the configuration of the antrum (Figs 58–66).

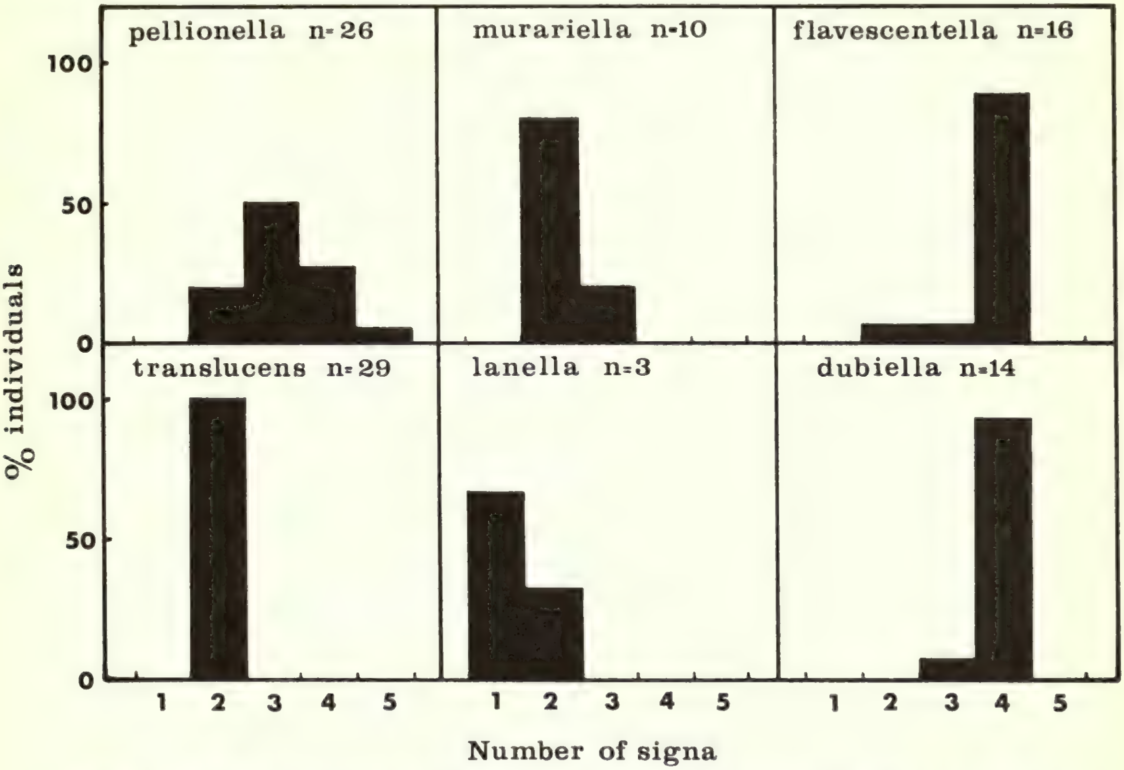

Fig. 2 Histograms of number of signa found in females of six species of *Tinea*. n = number in sample. (Original data are available from the author on request.)

BIOLOGY. The *Tinea pellionella* group includes all the species currently recognized as case-making clothes-moths (with the exception of *T. pallescentella* – see above) and these species are capable of utilizing most forms of keratin as a foodstuff. The list of domestic and industrial materials fed upon by the *pellionella*-group includes wool, fur, feathers, leather, silk, fish-meal and hooves and probably also horn (of which *Ceratophaga* spp. are the major pests). Where not associated with man, larvae of case-making clothes-moths are found feeding in keratin sources such as animal corpses, birds' nests, bird-pellets, mammal burrows and weathered carnivore faeces.

Case-making clothes-moths occupy climatic zones from subarctic (*bothniella*) to sub-desert (*murariella*) and humid tropical (*translucens*). The life-cycle and its timing is dependent upon temperature. Species developing in cold localities with a prolonged winter are univoltine (*bothniella*) while others in warmer environments are bivoltine (*dubiella* at low latitudes) or continuous-brooded (*translucens* in centrally heated houses or in the tropics). The timing of the life-cycles of different species at abnormally high temperatures (see *pellionella*, *murariella* and *translucens*) is very similar and the factors limiting distribution are, I believe, coldness and dryness. Curiously, no investigations have been made of the tolerance to low temperatures of members of the *pellionella*-group. The upper temperature limits of *murariella*, *pellionella* and *translucens* have been investigated (Cheema, 1956; Chauvin, 1977) and they seem to be similar and not to account for distribution. Further details of the biology and a bibliography of biological literature are given below for each species.

The larvae of the species of the *pellionella*-group are all (where known) case-makers, using particles of the food substrate and quantities of silk to produce a flattened case (Figs 102, 103) in which the larva lives. The shape and method of construction of the case is similar in all the species examined. Larvae pass through a minimum of five instars and when fully grown climb away from the food source and suspend themselves and their case from a (usually) horizontal surface; pupation occurs within the larval case and, shortly before emergence, the pupa protrudes itself from the case using the backward-pointed abdominal spines to work the head and thorax clear of the larval case (Figs 102, 103).

Several members of the *pellionella*-group, notably the pest species, have been recorded as having been transported by man as a result of trade, notably trade in wool, fur and hides. The populations of *pellionella*-group species in Australia and New Zealand are the result of importation and it is likely that the recent 'bongo-drum' outbreaks of *translucens* (q.v.) in Britain have their origins in individual infestations beginning in East or southern Africa.

At least four species have been successfully reared in the laboratory – *dubiella*, *murariella*, *translucens* and *pellionella*. Wakely (1962) reared *dubiella*; the other three species have been reared by me and by Chauvin (many papers – see bibliography). Chauvin rears his material on the skins of small mammals, keeping his cultures at 20–25 °C. My cultures are maintained at similar temperatures but are fed with wool (strips of old woollen clothing) sprinkled with fish-meal mixed with 10% dried yeast powder. Both *translucens* and *murariella* thrive under these conditions but the culturing of *pellionella* has so far proved to be very difficult: Chauvin (*pers. comm.*) also reports *pellionella* to be difficult to rear under artificial conditions. Few papers deal with the rearing of Tineidae but that by Billings (1936) is helpful.

PARASITES. Hymenopterous parasites of '*Tinea pellionella*' are recorded by Riley (1890–1), Marlatt (1915), Brèthes (1920), Nagamori (1925), Bruneteau (1930), Morley (1930), Voukassovitch & Voukassovitch (1931), Watanabe (1932), Morley & Rait-Smith (1933), Ferrière (1941), Burks (1943), Thompson (1947), Mason (1948), Richards (1949), Woodroffe & Southgate (1951*a*) and Nixon (1976). I consider that the host recorded as '*pellionella*' by Brèthes (1920) is *murariella* as this is the only species of the *pellionella*-group known from the eastern Neotropical region. Similarly, the '*pellionella*' of Nagamori (1925) and Watanabe (1932) is considered to be *translucens*. The remainder of the literature records are considered to refer correctly to *pellionella*. Of the parasite names used by the above authors, *Metacoelus mansuetor* Gravenhorst and *Hyperacmus tineae* Riley are now considered to be junior synonyms of *Hypsicera curvator* (F.) (Ichneumonidae), *Tetrastichus carpatus* Burks is a junior synonym of *T. tineivorus* Ferrière (Chalcidae), *Apanteles igae* Watanabe is a junior synonym of *A. carpatus* (Say) (Braconidae) and *Paramesocrina tineavora* Nagamori is a junior synonym of *Chremylus rubiginosus* (Nees) (Braconidae). According to Dr Z. Bouček (*pers. comm.*), the species of *Habrocytus* which in the experiments of Voukassovitch & Voukassovitch (1931) was found to attack *pellionella* is not *saxesenii* but very likely *H. semotus* (Walker) (Pteromalidae). During this study, *Hypsicera curvator* (F.) (Ichneumonidae) has been reared from *Tinea translucens* and Latvian specimens of *pellionella* and their associated parasites (collected by Lienig) have been found; the parasites were identified by Dr M. G. Fitton as *Gelis cinctus* (L.) (Ichneumonidae).

Predators of larvae include *Scenopinus fenestralis* (L.) (Diptera : Scenopidae) (Rothschild & Clay, 1952) and a spider (Key & Common, 1959).

The recorded parasites of the species of the *pellionella*-group are, in many cases, cosmopolitan and not restricted to feeding on larvae of case-making clothes-moths but are recorded from a number of species of Lepidoptera with small, case-making larvae. It is likely that parasites have been and are transported by man along with their hosts. There is no suggestion, from the lists of parasites given below, that any host-specificity is to be found among the parasites of the *pellionella*-group.

Lists of parasites are given below for each species for which records are available – *pellionella*, *translucens* and *murariella*.

Key to males

1 Tip of aedeagus with 4–8 spine-like carinae at apex (Figs 26, 27); saccus usually less than 0·60 mm long 2
– Tip of aedeagus without carinae or, if present, carinae not apical and spine-like; saccus usually more than 0·60 mm long 3
2 Aedeagus with two distorted blade-shaped cornuti (Fig. 27) . . . . ***roesleri*** (p. 71)
– Aedeagus with one small, slender cornutus (Fig. 26) . . . . ***flavescentella*** (p. 68)
3 Anellus spines large, arranged singly in a row (Figs 68, 69) 4
– Anellus spines small, arranged in a row at least three spines wide (Figs 28–42) 5
4 Spots in fore wing well-defined; base of costa with elongate hyaline spot; aedeagus without cornutus . . . . ***steueri*** (p. 91)
– Spots in fore wing absent or ill-defined; base of costa without elongate hyaline spot; aedeagus with single strong cornutus (Fig. 67) . . . . ***bothniella*** (p. 92)
5 Vesica without cornuti; carinae thorn-like, arranged longitudinally down sclerotized bars on either side of aedeagus . . . . ***hongorella*** (p. 94)
– Vesica with pair of large blade-shaped cornuti or pair of reduced apical or subapical cornuti. 6
6 Aedeagus with only two reduced apical or subapical cornuti which are not as long as aedeagus is wide . . . . ***dubiella*** (p. 88)
– Aedeagus with pair of strongly-developed blade-shaped cornuti which are longer than aedeagus is wide 7
7 Aedeagus with pair of large serrated carinae below apex (Fig. 25) . . . . ***lanella*** (p. 85)
– Carinae, if present, numerous, small and thorn-like 8
8 Vesica with at least four small cornuti usually protruding from tip of aedeagus (Figs 18–20) ***translucens*** (p. 79)
– No small cornuti protruding from tip of aedeagus; small cornuti, if present, are stout and situated at three-quarters length of aedeagus (as in Fig. 24) 9
9 Vesica with three small, stout cornuti at about three-quarters length of aedeagus (Fig. 24) ***messalina*** (p. 87)
– Vesica with pair of elongate, blade-shaped cornuti 10
10 Aedeagus with patch of small, thorn-like carinae either side of apex (Figs 14–16) ***pellionella*** (p. 72)
– Aedeagus without carinae (Figs 21–23) . . . . ***murariella*** (p. 83)

Key to females

[Females of *hongorella* are unknown]

1 Signa set in large, flat, circular sclerotized base-plates (Figs 50–52, 54) 2
– Signa set in unsclerotized membrane of corpus bursae (Figs 53, 55–57, 72, 75) 6
2 Anterior longitudinal folds of antrum without transverse division (Fig. 63) . ***messalina*** (p. 87)
– Anterior longitudinal folds of antrum with transverse division (Figs 58–60) 3
3 Corpus bursae with four or five signa . . . . ***pellionella*** (part) (p. 72)
– Corpus bursae with three or fewer signa 4
4 Anterior region of antrum more than half as wide as posterior (bulbous) region (Figs 50, 58); no annular sclerotization at anterior end of ductus bursae . . . . ***pellionella*** (part) (p. 72)
– Anterior region of antrum less than half as wide as posterior (bulbous) region (Figs 59, 60); with annular sclerotization at anterior end of ductus bursae 5
5 Longitudinal folds of antrum divided transversely in posterior half (Fig. 59); corpus bursae with two signa . . . . ***translucens*** (p. 79)
– Longitudinal folds of antrum divided transversely in anterior half (Fig. 60); corpus bursae with two or three signa . . . . ***murariella*** (p. 83)
6 Corpus bursae with more than five signa 7
– Corpus bursae with less than five signa 8
7 Antrum long and narrow (Fig. 65); fore wing with three dark dots . . . . ***roesleri*** (p. 71)
– Antrum short and broad (Figs 73, 74); fore wing without dots . . . . ***bothniella*** (p. 92)
8 Antrum wider than long (Fig. 66) . . . . ***steueri*** (p. 91)
– Antrum longer than wide 9
9 Corpus bursae with one or two signa . . . . ***lanella*** (p. 85)
– Corpus bursae with three or four signa 10
10 Signa small (Fig. 55); antrum short (Fig. 62) . . . . ***dubiella*** (p. 88)
– Signa large (Fig. 56); antrum long (Fig. 61) . . . . ***flavescentella*** (p. 68)

Descriptions of species

Tinea flavescentella Haworth

(Figs 1, 2, 6, 8, 26, 37–39, 46, 56, 61, 76, 82, 83, 103)

Tinea flavescentella Haworth, 1828, *Lepid. Britannica*: 564. Lectotype ♀, [Britain] (abdomen missing; UM, Oxford) designated by Bradley (1966*b* : 130) [examined].

Tinea tristigmatella O. G. Costa, [1836], *Fauna Regno Napoli*, Lepidotteri: [232], [312], pl. (Lep. Nott.) 4, fig. 8A. Type(s), Italy: Naples [not found; not examined]. [Synonymized by Walsingham, 1907 : 268.]

Tinea flavescentella Haworth; Stephens, 1829*a* : 51 [catalogue]; Stephens 1829*b* : 224 [catalogue]; Curtis, 1831 : 187 [list]; Stephens, 1834 : 346 [description]; Curtis, 1837 : 214 [list]; Wood, 1839 : 225, pl. fig. 1558 [description; figure of adult]; Stainton, 1849*a* : 8; Stainton, 1852 : 11, 39 [date of appearance of imago]; Stainton, 1854*b* : 15 [*partim* – catalogue]; Doubleday, 1859 : 27 [list]; Wocke, 1861 : 107 [catalogue]; Walker, 1863 : 469 [catalogue]; Wocke, 1871 : 270 [distribution; bibliography; catalogue]; Merrin, 1875 : 242 [no life-history data]; Hartmann, 1879, 3 : 199; Lafaury, 1886 : 410 [larval description; biology – determination not verified]; Meyrick, 1895 : 791 [synonym of *pellionella*]; Rebel, 1901 : 238 [synonym of *pellionella*]; Dyar, [1903] : 527 [synonym of *pellionella*]; Crombrugghe de Picquendaele, 1906 : 124 [synonym of *pellionella*]; Walsingham, 1907 : 268 [*partim* – bibliography, biology]; Waters, 1928 : 176 [bred from dead pigeon, Oxford]; Waters, 1929 : 58 [bred from dead pigeon, Oxford]; Pierce & Metcalfe, 1934 : 266 [genitalia]; Pierce & Metcalfe, 1935 : 95, pl. 58 [genitalia]; Walker & Hobby, 1939 : 105 [bred from dead pigeon, Oxford]; Corbet & Tams, 1943*b* : 111, 143, figs 231, 258, 286, pl. 5, figs 31, 32 [identification; distribution; biology]; Ford, 1949 : 184 [biology]; Bradley, 1953 : 18 (*partim* – 1 ♂ only) [Ireland]; Petersen, 1957 : 150, fig. 116 [♀ genitalia; Germany (West)]; Zagulajev, 1960 : 159 [description]; Petersen, 1962 : 208 [Dalmatia]; Petersen, 1963*b* : 414 [from birds' nests – doubtful record]; Lhomme, 1963 : 1101 [France – not verified]; Gozmány & Szőcs, 1965 : 142, figs 36C [poor], 37C [key; genitalia figures]; Căpuşe, 1968 : 331, figs 172A, 173A (partim – ♂ only) [Rumania]; Petersen, 1968 : 98 [Germany (West)]; Petersen, 1969 : 374, figs 153, 162, 170 [genitalia; biology; distribution; Germany (East)]; Hicks, 1971 : 178 [doubtful bird's nest record]; Bradley *et al.*, 1972 : 8 [checklist]; Hulme, 1972 : 184 [locality of P. B. Mason specimens probably Staffordshire]; Pallesen & Palm, 1973 : 104 [Denmark]; Hannemann, 1977 : 222, pl. 14, fig. 6, figs 122a–b [distribution (E. Germany); genitalia].

Tinea tristigmatella Costa; Zeller, 1847 : 808; Heydenreich, 1851 : 79 [list]; Stainton, 1869 : 267 ['*T. pellionella* ?']; Curò & Turati, 1883 : 11 [consider of doubtful status and refer to Zeller]; Walsingham, 1907 : 268 [synonym of *flavescentella*]; Corbet & Tams, 1943*b* : 111 [probable synonym of *flavescentella*]; Petersen, 1957 : 150 [synonym of *flavescentella*]; Petersen, 1969 : 374 [synonym of *flavescentella*]; Hannemann, 1977 : 222 [synonym of *flavescentella*]; Tremewan, 1977 : 227 [synonym of *pellionella*].

[*Tinea merdella* Zeller; Stainton, 1859*b* : 293, 466; Horton, 1859 : 109 [larva]; Doubleday, 1859 : 27; Morris, 1870 : 24, pl. 99. fig. 14 [description; figure]; Stainton, 1874 : 3; Merrin, 1875 : pp. [life-cycle]; Barrett, 1878 : 269 [Pembrokeshire]; Kane, 1900 : 127 [Ireland]; Pyett, 1902 : 3 [Suffolk]; Bloomfield, 1902 : 7 [Suffolk – as '*merdella* Zett.' (sic)]; Walsingham, 1907 : 268 (*partim*). Misidentifications.]

[*Tinea metonella* Pierce & Metcalfe; Pierce & Metcalfe, 1934 : 266 (*partim* – 1 ♀ only). Misidentification.]

[*Tinea pellionella* L.; Bradley, 1952 : 185 [Ireland]. Misidentification.]

♂ (Fig. 82). 8–12 mm. Head light fawn to cream. Maxillary palpus whitish, extending to just beyond second segment of labial palpus. Labial palpus cream, terminal segment with light brownish scales above and at sides. Galea very short, not reaching tip of first segment of labial palpus. Antenna brownish cream, almost reaching apex of fore wing. Thorax and tegula light fawn, speckled anteriorly with light brown scales. Fore wing light fawn, fringes concolorous, scales at base, posterior to fold and at termen slightly darker and more brownish. Discocellular, discal and plical spots pale creamy brown, large. Hind wing very light greyish brown, fringes paler. Legs cream, forelegs dusted above with pale brown. Abdomen light greyish brown.

♀ (Fig. 83). 11–17 mm. Coloration as ♂ but in some examples seen, vestiture of head darker and more reddish than in ♂ and ground colour of fore wing darker, light greyish brown.

Genitalia ♂. Saccus very short, 0·51 ± 0·12 mm long. Valva (Fig. 46) with apex more or less slightly truncated at costal margin. Dorsal margin of gnathos straight, tips curved inwards towards tip of uncus. Anellus spines (Figs 30, 37–39) large and protuberant but not numerous [specimens from Spain and Algeria (Figs 30, 38) have broader band of slightly smaller spines than in specimens from Britain (Figs 37, 39)]. Aedeagus (Fig. 26) 1·25 ± 0·19 mm long; tip with seven or eight stout carinae [four in Algerian, five in Spanish specimen]; vesica with single cornutus of similar size and shape to carinae, usually located level with them. Aedeagus/saccus ratio 2·48 ± 0·48.

GENITALIA ♀. Eighth sternite with broad U-shaped emargination (Fig. 61) with a more or less pronounced anterior nick. Antrum (Fig. 61) elongate, broadened posteriorly, with large lateral sclerotized patches; transverse folds pronounced; longitudinal folds scelerotized and conspicuous, not transversely divided. Corpus bursae (Fig. 56) with two to four densely sclerotized thorn-shaped signa grouped towards anterior end of corpus bursae; signa not set in sclerotized circular base-plates.

REMARKS. *Tinea flavescentella* is a distinctly pale-coloured species with larger and better-defined fore wing spots than in the other species here described. The male genitalia are remarkable in that the two blade-shaped cornuti present in most other members of the *pellionella*-group are lost in *flavescentella* and the saccus is very short. The shape, size and position of the signa in the female genitalia is diagnostic as is the characteristic broad and elongate antrum.

The specimens from Spain and Algeria included here differ slightly from other specimens examined in having fewer carinae on the aedeagus and a broader band of anellus spines. In addition, the Spanish specimen has a longer saccus and aedeagus (0·70 and 1·50 mm respectively) than other specimens of *flavescentella* examined. No significance can be attached to these differences without the detailed examination of further material of *flavescentella* from Spain and North Africa.

This is the '*Tinea merdella*' of nineteenth-century (notably British) authors (see Walsingham, 1907) but not of Cooke (1856) nor of Stainton (1857) (see below). Stainton's redescription of '*merdella*' has been generally assumed to be a misidentification of *flavescentella* (Walsingham, 1907, *et alii* including Petersen, 1957 : 150). Stainton described Cooke's specimens in this work and Cooke's specimens include the lectotype of *Tinea metonella* Pierce & Metcalfe, a species here considered to be a junior subjective synonym of *Tinea translucens* Meyrick. Thus '*Tinea merdella*' *sensu* Stainton, 1857 [1856 *auctorum* – see below] is a misidentification and referable to *translucens* and not to *flavescentella.*

Tinea merdella Zeller has, as pointed out by Walsingham (1907), nothing to do with the case-making clothes-moths and was referred to the genus *Paratinea* by Petersen (1957 : 159). Despite this, Zagulajev (1960 : 159) erroneously placed *merdella* Zeller as a synonym of *flavescentella* Haworth along with *dubiella* Stainton *sensu* Walsingham, 1907; no reasons are given for this. Walsingham (1907 : 268) considered *dubiella* to be a good species.

As far as can be ascertained from surviving specimens, all specimens of '*merdella*' referred to by British authors subsequent to Stainton (1857) and prior to Walsingham (1907) are *flavescentella* Haworth. Stainton's misidentification of certain specimens of *Niditinea fuscipunctella* (Haworth) as *flavescentella* (see Walsingham, 1907) further complicates matters, citations of *flavescentella* including Stainton's records thus being *partim* only. Several authors followed Meyrick (1895) in erroneously considering *flavescentella* to be a synonym of *pellionella.*

It cannot be accepted that the illustration of *Tinea tristigmatella* Costa is suggestive of affinity with *Paratinea merdella* (Zeller) as Zeller (1847 : 808) suggested, nor can it be accepted that Stainton (1869 : 267) synonymized *tristigmatella* with *pellionella* as stated by Tremewan (1977 : 227). Zeller (1847 : 808) referred Costa's *variety* of *tristigmatella* to *pellionella.* In the absence of type-material of *tristigmatella* (Hartig, 1939), the synonymy of Walsingham (1907 : 268) – that *tristigmatella* is a junior subjective synonym of *flavescentella* Haworth – should be accepted under the 'first reviser principle' and on the grounds that the illustration by Costa matches *flavescentella* and his description of the biology is compatible with what is known of the biology of *flavescentella.* This synonymy does not stretch credibility on geographic grounds.

All published genitalia figures of males of this species are sadly inadequate and misinterpret the structure of the aedeagus.

Stainton's redescription of '*merdella*' (see above) has been dated 1856 by authors following Walsingham (1907). I can find no published evidence that the *Entomologist's Annual* for 1857 was published in 1856 and I therefore take the date of publication to be that cited on wrappers and title-page – 1857.

BIOLOGY. I have examined specimens carrying accurate label data saying how they were reared (see below) and these refer *flavescentella* to the status of a feather-feeder; Fletcher's specimens may provide evidence that it is also capable of feeding on insect remains and Barrett's record

(1878 : 269) that it may also feed on fur. It has been recorded from inside dwellings and Jacobs' specimens from Smith's Wharf are from inside a warehouse (*pers. comm.*). Distribution records of *flavescentella* suggest that it is restricted to temperate western Europe and the Mediterranean region. It has not, apparently, been collected outdoors in temperate western Europe and may be incapable of a permanent outdoor existence in temperate regions.

Barrett's record of this species breeding in a muff (1878 : 269) can now be confirmed by only a single specimen: muffs were traditionally of fur but could contain other materials. Other published records of the biology of *flavescentella* should be treated with caution as the specimens may well have been misidentified and cannot now be traced and checked: they refer to larvae attacking baize (Pyett, 1902), a woollen pen-wiper (Horton, 1859) and a dead pigeon (Waters, 1928; 1929; Walker & Hobby, 1939). Lafaury (1886 : 410) described the larva of *flavescentella* and pointed out that, in contrast with *pellionella*, it passed the winter without feeding: his identification of *flavescentella* cannot now be verified. Examined specimens in BMNH are reliably labelled as being bred from 'feathers' and 'feathers and dead bluebottles' (*Fletcher*) and 'feathers' (*Jacobs*). Dates of collection of adults are February to August inclusive and November: specimens examined include individuals reared under domestic (warm) conditions.

Zagulajev (1960 : 160) gives a detailed account of the biology of *flavescentella* (a species which he states to be unknown to him), stating that it lives in birds' nests, old buildings and bat roosts, that the larvae hibernate, that larvae sometimes develop in houses and infest both coarse and finished felt. The sources he cites for this information are Barrett (1878 – larvae in a house in a muff), Kane (1900 – adults in houses), Bloomfield, Pyett (1902 – larvae on baize) and Corbet & Tams (1943*b* – larvae on furs and woollen material). Larval hibernation is recorded by Lafaury (see above) but this source is not quoted by Zagulajev. There thus appears to be no factual basis for his suggestions that *flavescentella* is nidicolous and associated with bat roosts. Zagulajev's assertion that *flavescentella* is nidicolous has been quoted without comment by Petersen (1963*b* : 414) and Hicks (1971 : 178).

DISTRIBUTION. (Fig. 76.) Great Britain, Ireland, Spain, Algeria. The following additional locality records from the literature are here accepted as reliable: Denmark (Pallesen & Palm, 1973), Germany (West and East) (Petersen, 1957; 1969; Hannemann, 1977), Yugoslavia (Petersen, 1962), Rumania (Căpuşe, 1968), Italy (Costa, [1836]).

Walsingham's (1907) records of *flavescentella* from France and Spain (the record from Italy is based on *tristigmatella*) cannot be accepted: Walsingham's Spanish specimen has not been found and the record for France (based on Lafaury, 1886) cannot be confirmed. To these records of Walsingham's, Zagulajev (1960 : 159) adds Algeria and Turkey. Both records are erroneous. Zagulajev (1960 : 83) gives Walsingham's paper on *flavescentella* the title of an earlier and entirely unrelated paper on Algerian Microlepidoptera in the same journal and thus may have assumed *flavescentella* to be an Algerian species. His Turkish record refers, of course, to true *Paratinea merdella* (Zeller) from Constantinople, the point of Walsingham's 1907 paper separating *merdella* and *flavescentella* having been missed.

Lhomme (1963 : 1101) records *flavescentella* from four localities in France but these records require verification.

MATERIAL EXAMINED

92 ex. (18 ♂, 20 ♀ genitalia preparations), 0 larvae, 2 cases, 2 pupae. **Great Britain**: 9 ex., Gloucestershire, Stroud, bred from feathers or from feathers and bluebottles, various dates 13.iv.1935 to 9.vii.1936 (*Fletcher*); 2 ♂, Wiltshire, Marlborough, 26.vi.1890 (*Meyrick*); 8 ex., Greater London, E.C., Smith's Wharf, ex feathers, various dates 15.ii.1945 to 25.v.1945 (*Jacobs*); 1 ♂, Greater London, E.C., 30.vi.1934 (*Jacobs*); 2 ♀, Greater London, Greenwich, no date, ex Sich coll.; 3 ♂, 1 ♀, Dorset, Corfe Castle, various dates 1.viii.1892 to 5.viii.1898 (*Bankes*); 1 ♀, Dorset, Chick[erell], 25.vii.1891 (*Bankes*); 3 ♀, Dorset, Weymouth, ii.1895 (*Richardson*); 1 ♀, Merseyside, Liverpool, no date (*Pierce*) (paralectotype of *metonella* Pierce & Metcalfe); 4 ex., no data, ex Meyrick coll.; 2 ♀, no data, ex Vine coll.; 1 ex., no data, ex Hodgkinson coll.; 14 ex., no data, ex Walsingham coll.; 6 ex., no data, ex Douglas coll.; 4 ex., no data, ex Stevens coll.; 19 ex., no data [? Staffordshire – see Hulme, 1972], ex Mason coll.; 2 ex., no data, ex Tyerman coll.; 1 ♀, no data, 30.viii.1884 (*Tutt*); 4 ex., no data, 9.xi.1883 (*Sang*); 1 ♀, no data, 1877 (*Barrett*).

Ireland: 1 ♂, Co. Clare, Burren, 3–8.vi.1951 (*Bradley*); 1 ♂, Co. Cork, Bantry, 4–15.vi.1952 (*Bradley*). **Spain**: 1 ♂, Prov. Avila, Sierra de Gredos, Garganta de las Pozas, 1800 m, 12.vii.1970 (*Sattler & Kirby*). **Algeria**: 1 ♂, Prov. Oran, Sidi-bel-Abbés, 2.ix.1917 (*Rotran*).

Tinea roesleri Gozmány
(Figs 1, 27, 40, 57, 65, 76, 84)

Tinea roesleri Gozmány, 1969, *Ent. Z., Frankf. a. M.* **79** : 69, figs 1, 2. Holotype ♂, SOUTH WEST AFRICA: Mariental, Galtsabis Farm, bred from owl pellets, 9.iv.1965 (*Schwind*) (genitalia slide no. 2244 [Petersen]; MAK, Bonn) [not examined].

Tinea roesleri Gozmány; Gozmány & Vári, 1973 : 50, figs 107, 108 [redescription].

♂. 9–10 mm. Head light greyish cream. Maxillary palpus whitish. Labial palpus whitish, terminal segment with light brownish scales on outer surface at one-half. [Head preparation not made owing to lack of material]. Galea apparently short as in *flavescentella*. Antenna brownish white, almost reaching apex of fore wing. Thorax and tegula greyish cream, tegula speckled anteriorly with a few light brown scales. Fore wing dull greyish cream speckled all over with light brownish grey scales; fringes light brownish grey. Discocellular spot present, small, ill-defined, greyish brown; discal and plical spots absent. Hind wing greyish white speckled with light brownish grey scales, fringes pale brownish grey. Legs whitish, fore leg greyish brown above. Abdomen greyish brown.

♀ (Fig. 84). 14 mm. Coloration as ♂.

GENITALIA ♂. [One genitalia slide examined.] Saccus very short, 0·55 mm long. Costa of valva concave to three-quarters, rounded to apex without noticeable truncation. Dorsal margin of gnathos angled at one-third, otherwise straight, tip curved inwards towards tip of uncus. Anellus spines (Fig. 40) short and broad, arranged in fairly narrow band with about 16 spines prominent. Aedeagus (Fig. 27) short, 1·03 mm long; tip with seven prominent carinae; vesica with pair of distorted blade-shaped cornuti. Aedeagus/saccus ratio 1·86.

GENITALIA ♀. [One genitalia slide examined.] Eighth sternite with deep and narrow U-shaped emargination. Antrum (Fig. 65) elongate, swollen posterior region narrow; transverse folds present but ill-defined; longitudinal folds conspicuous, not divided transversely. Corpus bursae (Fig. 57) with six minute, thorn-like signa arising from very small, circular sclerotized base-plates.

REMARKS. *Tinea roesleri* is a darker and more dull-coloured species than *flavescentella* and, under low magnification, has a distinctly speckled appearance. The configuration of carinae at the tip of the aedeagus is similar to that of *flavescentella* but *roesleri* possesses large blade-shaped cornuti similar to those of most other members of the *pellionella*-group. These are, however, distinctly contorted to a shape not observed in other members of the *pellionella*-group. The female genitalia of *roesleri* resemble those of *murariella* and *translucens* but in *roesleri* the longitudinal folds of the antrum are not transversely divided; the signa of *roesleri* are smaller and more numerous than those of *translucens* or *murariella*.

In his descriptions of this species, Gozmány (1969 : 69; Gozmány & Vári, 1973 : 50) claims that the female has two large signa 'resembling those of *pellionella*'. His figure shows four very small signa. In the case of the male he interprets the carinae as cornuti. He states that the aedeagus is as broad as the valva (Gozmány & Vári, 1973 : 50) but in the specimen examined, the aedeagus is less than two-thirds the width of the valva and even if compressed flat beneath the coverslip would not be as wide.

This species is known only from the type-series which consists either of holotype and 74 paratypes (Gozmány, 1969 : 71) or holotype and 70 paratypes (Gozmány & Vári, 1973 : 50).

BIOLOGY. *Tinea roesleri* is known only from Mariental, near the edge of the Namib Desert: larvae were found feeding in owl pellets which would probably have contained fur and insect remains. Exact details of the type-locality are not available but there is enormous diurnal variation in both temperature and humidity in this area. This species may be adapted to scrub desert conditions or it may have been breeding in less extreme conditions in farm buildings. Adults emerged in April.

DISTRIBUTION. (Fig. 76.) South West Africa.

MATERIAL EXAMINED

3 ex. (1 ♂, 1 ♀ genitalia preparation), 0 larvae, 3 cases, 0 pupae. **South West Africa**: 2 ♂, 1 ♀, Mariental, Galtsabis Farm, bred from owl pellets, 9.iv.1965 (*Schwind*) (genitalia slide nos G–01, 1328; TM, Budapest and BMNH, London) (paratypes).

Tinea pellionella Linnaeus

(Figs 1, 2, 4, 14–16, 28, 29, 43, 50, 58, 77, 85, 86)

Phalaena (*Tinea*) *pellionella* Linnaeus, 1758, *Syst. Nat.* (edn 10) **1** : 536. Neotype ♂, [BRITAIN]: abdomen and genitalia (the extreme right specimen with gnathos and uncus in dorsoventral view) on F. N. Pierce Slide No. 3222 (BMNH, London) designated by Rasmussen (1964 : 336, pl. 2, fig. 5) [examined].

Phalaena zoolegella Scopoli, 1763, *Ent. carniolica* : 255. Type[s], [YUGOSLAVIA] (assumed to be destroyed – see Horn & Kahle, 1936 : 252). [Synonymized by Zeller, 1839 : 184.]

Tinea albella O. G. Costa, [1836], *Fauna Regno Napoli*, Lepidotteri: [231], [234], [312], pl. (Lep. Nott.) 4, fig. 9A (nom. praeocc.). Types, ITALY: Naples [not found; not examined]. [Synonymized by Stainton, 1869 : 267.]

Tinea demiurga Meyrick, 1920, *Exot. Microlepidopt.* **2** : 354. LECTOTYPE ♂, INDIA: Assam, Shillong, vi.1920 (*Fletcher*) (genitalia slide no. 13301; BMNH), here designated [examined]. **Syn. n.**

Tinea gerasimovi Zagulajev, 1978, *Ent. Obozr.* **57** : 622, figs 10, 11. Holotype ♂, U.S.S.R.: Central Asia [?] (*Gerasimov*) (genitalia prep. no. 8627; ZI, Leningrad) [examined]. **Syn. n.**

[*Tinea pellionella* L.]; Cuba, 1491 : Animalibus cxlv, woodcut [description; herbal remedies; woodcut of woman brushing moth-damaged garments]; Anonymous, 1521 : 73 [damage; control; woodcut from Cuba, 1491; see quotation in 'Introduction']; Moffett, 1634 : 97 [description; figure]; Réaumur, 1737 : 41, pls 5, 6 (excluding pl. 6, figs 9, 10) [damage; biology; case-building and larval behaviour; control]; Rösel von Rosenhof, 1746 : 46, pl. 17, figs 1–6 [description; biology; excellent colour figs of life history]; Anonymous, 1759 : 365 [biology; control]; Kalm, 1771 : 8 [first North American record]; Ebert, 1778 : 95 [description; damage].

Tinea pellionella L.; Linnaeus, 1761 : 364 [description]; Poda, 1761 : 94, pl. 2, fig. 12 [adult and case figured]; Müller, 1764 : 57 [description]; Fabricius, 1775 : 659; Fuessli, 1775 : 42 [Switzerland]; Müller, 1776 : 134 [description]; Mader, 1777 : 119 [dates of appearance]; Fischer, 1778 : 155 [Livonia]; Leske, 1779 : 464 [description]; Fabricius, 1781 : 295; Goeze, 1783 : 92 [bibliography]; Strøm, 1786 : 340 [Norway]; Fabricius, 1787 : 246; de Villers, 1789 : 466 [bibliography]; Rossi, 1790 : 205; Fabricius, 1794 : 304; Hübner, 1796 : 61, pl. 3, fig. 15; Fabricius, 1798 : 490; Cederhielm, 1798 : 256 [description; bibliography]; Geoffroy, 1800 : 184 [description; damage – see also p. 173); Stewart, 1802 : 198; de Tigny, 1802 : 92, pl. facing 94, figs 3–6 [description; figures]; Walckenaer, 1802 : 318 [as '*pelionella* F.']; Schrank, 1802 : 106 [description]; Haworth, 1802 : 37; Latreille, 1805 : 249 [description]; Kirby & Spence, 1818 : 233 [damage]; Samouelle, 1819 : 249, 370 [description; dates of appearance; as '*Physis pelionella*']; Schmid, 1822 : 129, pl. 19, fig. 4 [description; figure]; Hübner, 1825 : 401; Hübner, 1826 : 70; Haworth, 1828 : 563; Stark, 1828 : 369; Stephens, 1829*a* : 51; Stephens, 1829*b* : 224; Curtis, 1831 : 187; Rennie, 1832 : 222 [description; biology]; Kollar, 1832 : 87 [Austria]; Treitschke, 1832 : (1)15 [life history; description of case and larva]; Eversmann, 1834: 21 [central U.S.S.R.]; Stephens, 1834 : 345 [description]; Costa, [1836] : [214] [description; Italy]; Kollar, 1837 : 392 [description; damage]; Curtis, 1837 : 215; Duponchel, 1838 : 92, pl. 289, fig. 1 [biology; description]; Zeller, 1838 : 708 [description; differentiation of *bisselliella*]; Wood, 1839 : 224, pl. 49, fig. 1555 [description; figure of adult]; Zeller, 1839 : 184; Döring *et alii*, 1840–46 : (**1**)6, (**2**)12, (**3**)16; (**4**)16, (**5**)16, (**7**)16; Zetterstedt, 1840 : 992 [description; Scania, Lapponia]; Harris, 1841 : 360; Eversmann, 1844 : 534 [larva and case; damage; Volga – Urals region of U.S.S.R.]; Treitschke, 1844 : 390; Humphreys & Westwood, 1845 : 246, pl. 118, fig. 10; von Tiedemann, 1845 : 543 [Prussia]; Duponchel, 1846 : 364; Lienig & Zeller, 1846 : 272 [parasites; description of larva and adult]; Kolenati, 1846 : 109 [Transcaucasia]; Koch, 1848 : 950 [Germany]; Stainton, 1849*a* : 8; Stainton, 1849*b* : 2630; Stainton, 1851 : 17 [Vienna]; Heydenreich, 1851 : 79; Zeller, 1852 : 157 [description; variation; bibliography]; Stainton, 1852 : 11 *et seq.* [dates of generations]; Ghiliani, 1852 : 79 [Italy]; Herrich-Schäffer, 1853 : 72, fig. 278; Stainton, 1854*a* : 33; Stainton, 1854*b* : 14 [bibliography]; Koch, 1856 : 378; Frey, 1856 : 25 [Switzerland]; Freyer, 1856 : 59, pl. 11, fig. 27 [description; damage]; de Fré, 1858 : 112 [dates of appearance of adult; larval damage; Belgium]; Praun, 1858–1870 : Tineacea, pl. 1, fig. 18 and facing p. [figure; description]; Stainton, 1859*b* : 292 [description; localities in Britain]; Doubleday, 1859 : 27; Nowicki, 1860 : 168; Wocke, 1861 : 107; Walker, 1863 : 468 [Britain; Europe; *partim* – not Ceylon]; Werneburg, 1864 : (1)18, 37, 165, 232, 298, 312, 469, 479, (2)253 [bibliography]; Rössler, 1866 : 316; Constant, 1866 : 308 [French vernacular names; foodstuffs] Stainton, 1867*b* : 265 [description; biology]; Speyer, 1868 : 255, pl. 34, fig. 9 [description; figure]; Cornelius, 1869 : 410 [birds' nests]; Stainton, 1869 : 56, 116, 126, 266, 284, 307, 322 [S. Europe]; Heinemann, 1870 : 54; Morris, 1870 : 22, pl. 99, fig. 7; de Graaf, 1870 : 146, pl. 34, figs 1–12 [biology; excellent colour plate of life-history]; Wocke, 1871 : 270; Peyerimhoff, 1872 : 142 [Alsace]; Haas, 1874–5 : 5 [biology; Denmark]; Hofmann, 1875 : 70 [biology]; Merrin, 1875 : pp. [annual cycle]; Millière, (1876) : 308; Chambers, 1878 : 164; Hartmann, 1879 : 199; Seebold, 1879 : 125 [Spain]; Frey, 1880 : 337 [Switzerland]; Fettig, 1882 : 88 [variation; damage; Alsace]; Cholodkowsky, 1882 : 262 [notes on anatomy]; Snellen, 1882 : 468 [Netherlands]; Walsingham, 1882 : 170 [North American records and literature; synonymy]; Fernald, 1882 : 166 [North American nomenclature of clothes-moths – see Walsingham, 1882]; Porritt, 1883 : 134 [Britain – Yorkshire]; Curò & Turati, 1883 : 8 [Italy]; Fernald, 1884 : 439, fig. 558; Farren, 1886 : 78 [Britain – Cambridgeshire]; Sorhagen, 1886 : 148 [generations; Berlin area]; Lafaury, 1886 : 411 [biology]; Edwards, 1889 : 120 [bibliography of life-history data]; Riley, 1890 : 212 [figures of larva, case and adult]; Oudemans, 1890 : xxx [biology]; Riley, 1890–1 : 15, 461 [parasites]; Riley, 1891 : 96; Fletcher, 1893 : 54, figs 32–34 [biology; damage]; Griffini, 1895 : 231, fig. 148; Comstock & Comstock, 1895 : 257 [biology; control]; Meyrick, 1895 : 791 [Britain; *partim* – not *dubiella* Stainton or *flavescentella* Haworth]; Butler, 1896 : 92; Marlatt, 1896 : 63, fig. 25 [biology; control]; Reutti, 1898 : 303 [Europe]; Seebold, 1898 : 162 [Spain]; Kane, 1900 : 127 [Ireland]; Rebel, 1901 : 238; Strand, 1901 : 38 [Norway]; Schütze, 1902 : 3 [Germany (East)]; Dyar, [1903] : 572; Rebel, 1904 : 373 [Balkans]; Dietz, 1905 : 51 [description; distinct from *griseella* and *carnariella*; U.S.A.]; Jussel, 1905 : 21 [birds' nests]; Crombrugghe de Picquendaele, 1906 : 124 [dates of larvae and adults; bibliography; Belgium]; Walsingham, 1907 : 267 [biology; bibliography]; Poole, 1909 : 432 [Britain – I. of Wight]; Meess, 1910 : 461 [distribution]; Gianelli, 1911 : 119 [damage; Italy]; Hauder, 1912 : 284; Herrick, 1914 : 189, figs 52, 53 [biology; control; good figures of case and adult]; Marlatt, 1915 : 1 [biology; damage; control]; Ossipov, 1915 : 897 [repelled by *Melilotus officinalis*]; Andres, 1916 : 51 [Malta]; Andres, 1918 : 366 [control with HCN gas]; Titschack, 1922 : 1 [comparisons with *bisselliella*; egg – fig. 62]; Wolff & Krausse, 1922 : 41 [pest status]; d'Abadie, 1922 : 212 [in swallows' nests]; Back, 1923 : 1 [control – see Back, 1935]; Rebel, 1927 : 63 [Cyprus]; Waters, 1928 : 176, 177 [Britain – Oxford district – in houses and birds' nests]; Forbes, 1928 : 538 [U.S.A. – New York]; Metcalf & Flint, 1928 : 748, fig. 504 [biology; damage, control]; Ford, 1929 : 261 [birds' nests]; Waters, 1929 : 58 [sparrows' nest, Oxford]; Bruneteau, 1930 : 149 [biology; control; parasites; bibliography]; Back & Cotton, 1930 : 835 [damage; useful period bibliography on control and of popular accounts]; Morley, 1930 : 101 [parasite]; Voukassovitch & Voukassovitch, 1931 : 695 [parasite]; Ford, 1931 : 259 [common in stables]; Back & Cotton, 1931 : 1 [damage to upholstered furniture; biology; control]; Schütze, 1931 : 211 [biology]; Burgess & Poole, 1931 : 141 [damage]; Morley & Rait-Smith, 1933 : 174 [parasites]; Eckstein, 1933 : 187, pl. 7, fig. 315 [description of larva and adult]; Britten, 1935 : 18 [in swallows' nests]; Donisthorpe, 1935 : 70 [in herons' nest]; Back, 1935 : 1 [biology; control]; Pierce & Metcalfe, 1935 : 94, pl. 58 [♂, ♀ genitalia]; Nordberg, 1936 : pp. [in birds' nests]; Herfs, 1936 : 1, 5 [in sparrows' nests]; Britten, 1936 : 110 [in swallows' nests]; Skala, 1936 : 172 [Czechoslovakia]; Rapp, 1936 : 219 [Thuringia]; Thompson, 1937 : 88 [from puffins' burrows, Ireland – N. Antrim]; Eichler, 1937 : 61 [birds' nests]; Pappenheim, 1938 : 240 [structure of eggs]; Uhlmann, 1938 : 8 [birds' nests; pest status]; Kemper, 1938*a* : 227 [birds' nests]; Kemper, 1938*b* : 272 [birds' nests]; Hudson, 1939 : 467, pl. 61, fig. 22 [larva; damage; description; New Zealand]; McDunnough, 1939 : 105 [U.S.A.]; Hartnack, 1939 : 186 [damage; identification; humidity requirement over 75% R.H.]; Herter, 1939 : 746 [birds' nests]: Walker & Hobby, 1939 : 105 [Britain – Oxfordshire]; Jellison, 1940 : pp. [birds' nests]; Ferrière, 1941 : 374 [parasites]; Burks, 1943 : 566 [hyperparasitism]; Corbet & Tams, 1943*a* : 113 [type-species of *Tinaea* Geoffroy – see also ICZN, 1957]; Corbet & Tams, 1943*b* : 111, 143, figs 199, 229, 256, 284, pl. 5, figs 29, 30 [identification; distribution; biology]; Hinton, 1943 : 211, fig. 127 [larva]; Doner & Thomssen, 1943 : 102 [biology; control, economic bibliography]; Jenkins, 1944 : 52 [biology; control]; Linsley, 1946 : 12 [birds' nests as infestation sources]; Thompson, 1947 : 580 [parasites]; Mason, 1948 : 28 [parasite]; Richards, 1949 : 29, 32 [parasites]; Ford, 1949 : 184 [biology]; Woodroffe & Southgate, 1950 : 30 [birds' nests]; Southgate & Woodroffe, 1951 : 44 [birds' nests]; Woodroffe & Southgate, 1951*a* : 171 [parasite]; Woodroffe & Southgate, 1951*b* : 55 [birds' nests]; Pest Infestation Research Board, 1951 : 5 [birds' nests]; Rothschild & Clay, 1952 : 250 [birds' nests]; Weidner, 1952 : 119, 134 [birds' nests]; Agenjo, 1952 : 61 [Spain]; Woodroffe, 1953 : 743, 745 [birds' nests]; Herter, 1953 : pp. [development temperatures]; Hudson, 1954 : 73 [facsimile of Anonymous, 1521 and woodcut]; Prevett, 1954 : 3 [on dead pheasant]; Hinton, 1956 : 303, figs 147–160 [description of larva; bibliography]; Viette, 1957 : 116 [birds' nests]; Petersen, 1957 : 145, figs 109, 110 [genitalia]; ICZN, 1957 : 254 [placed on Official List of Specific Names in Zoology; type-species of *Tinea*]; Werner, 1958 : 97, figs 142–144 [larval description]; Zagulajev, 1958 : 42 [biology; control]; Hicks, 1959 : 275 [bibliography of birds' nest records];

Petersen, 1959*b*: 156 [Germany; *partim* – 2 ♀ are *dubiella*]; Key & Common, 1959: 29 [ecology in a bulk wool store, Australia]; Petersen, 1960: 226 [Spain]; Zagulajev, 1960: 149, figs [identification; biology; distribution; U.S.S.R.]; Razowski & Śliwiński, 1961: 42 [Poland; domestic pest; as *Tineola pellionella*]; Woodroffe, 1961: 281 [birds' nests]; Petersen, 1961*b*: 58 [Germany]; Hicks, 1962: 267 [bibliography of birds' nest records]; Lhomme, 1963: 1100 [France; Belgium]; Petersen, 1963*b*: 414 [birds' nests]; Petersen, 1963*c*: 12 [Albanian records rejected]; Hartig, 1964: 225 [Italy – Venice region]; Petersen, 1964*b*: 77 [status as 'domestic' species]; Petersen, 1964*c*: 121 [Germany]; Petersen, 1964*d*: 404, 417 [Spain]; Rasmussen, 1964: 336, pls 1–4, figs 1–16 [♂, ♀ genitalia; neotype designated]; Mitchell & Zim, 1964: 153, col. fig. [popular account; figure of adult]; Opheim, 1965: 57 [Norway]; Anonymous, 1965: 1 [moth-proofing and control; bibliography on moth-proofing techniques]; Gozmány & Szőcs, 1965: 142, figs 36A, 37A, 38A, 38B [key; Hungary; genitalia figures]; Gradidge *et alii*, 1967: 8, fig. 6 [biology; damage; control]; Căpuşe, 1968: 319, figs 11E, 13A, 19A, 165, 166, 169A [Rumania; figures mostly from Zagulajev, Hinton and Petersen – original figures wholly inaccurate]; Klimesch, 1968: 182 [Macedonia]; Petersen, 1968: 98 [Germany (West)]; Chauvin, 1968*a*: 40 [activity]; Chauvin, 1968*b*: 49 [adult activity]; Chauvin, 1968*c*: 431 [case-building]; Chauvin, 1968*d*: 2229 [larval activity as function of egg weight]; Chauvin, 1969*a*: 2673 [ovaries]; Chauvin, 1969*b*: 23 [adult and larval activity]; Chauvin, 1969*c*: 89 [case-building activity]; Petersen, 1969: 373, pl. fig. 24, figs 150, 159, 167 [♂, ♀ genitalia; biology; distribution; Germany (East) – all regions except Schwerin, Suhl and Leipzig]; Chauvin, 1970: 9 [case-building activity]; Chauvin, 1971*a*: 1111 [humidity and survival]; Chauvin, 1971*b*: 509 [fecundity]; Chauvin, 1971*c*: 350 [activity rhythms]; Krogerus *et alii*, 1971: 28 [Scandinavia]; Hicks, 1971: 178 [bibliography of birds' nest records]; Zagulajev, 1972: 684 [Mongolia]; Bradley *et alii*, 1972: 8; Barbier & Chauvin, 1972: 1003 [studies on ova]; Bollobás & Vojnits, 1972: 467 [damage to human anatomical preparations]; Opheim, 1973: 44, fig. 7 [Norway; records from birds' nests]; Ebeling, 1975: 314, fig. 203 [biology; figure of case]; Nixon, 1976: 706 [parasite]; Hannemann, 1977: 217, pl. 14, fig. 9, figs 118a–c, A33, A34 [larva; genitalia; biology; Germany (East)]; Chauvin, 1977: 1 [detailed and important study of humidity tolerance and adaptation to dry environments]; Mourier & Winding, 1977: 96, pl. 6 [coloured figs of larva, case and adult].

Tinea zoolegella Scopoli; Goeze, 1783: 92, 149 [catalogue]; Zeller, 1839: 184 [as variety of *pellionella*]; Duponchel, 1846: 364 [as variety of *pellionella*]; Herrich-Schäffer, 1853: 72 [synonym of *pellionella*]; Zeller, 1855: 256 [synonym of *pellionella*]; Frey, 1856: 25 [synonym of *pellionella*]; Werneburg, 1864: (1)233 [synonym of *pellionella*]; Stainton, 1869: 307 [synonym of *pellionella*].

Tinea albella O. G. Costa; Curò & Turati, 1883: 10 [not known to authors]; Stainton, 1869: 267 [? junior subjective synonym of *pellionella*]; Tremewan, 1977: 220 [current status; junior primary homonym of *albella* Thunberg].

[*Tinea flavifrontella* Hübner; Packard, 1867: 423 (*partim* – larva only) [description; biology]; Packard, 1873: 64, figs 57–60 (*partim* – larva only); Williams, 1874: 27; Walsingham, 1882: 170 [misidentification of *pellionella* attributed to Packard]; Fernald, 1882: 169 [misidentification of *pellionella* attributed to Packard]; Packard, 1888: 346; Denton, 1900: 45, fig. [popular account]. Misidentifications.]

[*Tinea griseella* Chambers; Fernald, 1882: 169 [synonym of *pellionella*]; Walsingham, 1882: 170 [synonym of *pellionella*]; Riley, 1891: 96 [synonym of *pellionella*]; Dyar, [1903]: 572 [synonym of *pellionella*]. Misidentifications.]

[*Tinea carnariella* Clemens; Walsingham, 1882: 170 [synonym of *pellionella*]; Fernald, 1882: 169 [synonym of *pellionella*]. Misidentifications.]

[*Tinea merdella* Zeller; Dyar, [1903]: 572 [synonym of *pellionella*]; Crombrugghe de Picquendaele, 1906: 124 [synonym of *pellionella*]. Misidentifications.]

[*Tinea murariella* Staudinger; Căpuşe, 1968: 334, figs 175A, 175B (*partim* – ♂ only). Misidentification.]

♂ (Fig. 85). 9–13 mm. Head rich brown with slightly reddish tint. Maxillary palpus brownish grey, almost reaching tip of third segment of labial palpus. Labial palpus greyish brown, outer surface of terminal segment darker. Galea extending almost to one-half of second segment of labial palpus. Antenna greyish brown, almost reaching apex of fore wing. Thorax and tegula greyish brown. Fore wing greyish brown, closely speckled with darker scales to give an overall dark, dull brown coloration; basal scales posterior to fold and scales forming discocellular, discal and plical spots dark brown and closely-packed. Hind wing very light grey with a slight brownish tint, scales somewhat darker towards margins, fringes concolorous. Legs light greyish brown, fore legs slightly darker above. Abdomen light greyish brown.

♀ (Fig. 86). 11–16 mm. Coloration as ♂.

GENITALIA ♂. Saccus elongate, 0·84 ± 0·18 mm long. Valva (Fig. 43) of rather variable shape, costa gently concave, apex not noticeably truncated at costal margin. Dorsal margin of gnathos straight, tip upturned towards uncus. Anellus spines (Figs 28, 29) of medium size, only slightly protuberant [Fig. 28 is of an atypical specimen], in a short row usually three spines wide and comprising 15–20 heavily sclerotized spines. Aedeagus (Figs 14–16) 1·22 ± 0·20 mm long, curved; patch of five to ten minute, thorn-like carinae at either side below apex; vesica with pair of large, evenly-tapered, blade-shaped cornuti – these visible in dorsoventral view (Fig. 15) only if aedeagus viewed with curve towards observer and more usually seen in lateral view (Figs 14, 16) in which their twisted shape is more apparent. Aedeagus/saccus ratio 1·47 ± 0·25.

GENITALIA ♀. Eighth sternite with broad V-shaped emargination (Figs 50, 58) with small, lateral sclerotized patches at base of emargination. Antrum (Fig. 58) short, broadened posteriorly into an almost spherical chamber in which transverse folds are weakly developed and weakly sclerotized; longitudinal folds short, conspicuous, transversely divided in posterior half. Corpus bursae (Fig. 50) with two to five conspicuous, needle-like signa, each arising from one side of a short, broad, blade-shaped eccentric base which may be doubly-peaked, 'needle' arising from base of smaller peak; each 'needle and base' set in dished, circular, sclerotized base-plate which is evenly sclerotized and has regular margin.

REMARKS. *Tinea pellionella* is a dark species with well-defined fore wing spots. The hind wing is pale in comparison with *dubiella*; *pellionella* is generally the larger species. The male genitalia are remarkable in that the vesical ornamentation consists of two plain, blade-shaped cornuti and the carinae on the aedeagus are very small and thorn-like. Carinae of this type are found in no other member of the *pellionella*-group although they resemble superficially the carinae of *hongorella* (q.v.). The short and bulbous female antrum is characteristic. (See also 'Remarks' for *translucens*.)

The literature on this species is diverse and covers a long period of human history (see above). The majority of the references to *pellionella* cannot now be verified because substantive specimens are no longer available or were never retained. Where I can find no evidence to doubt a record of *pellionella* I have included it in the list of citations (above). I consider a number of the traditionally-cited references to this species to involve misidentifications; *pellionella* is not known from the localities to which these references apply and, moreover, may be known to be replaced by other species of the *pellionella*-group. Biblical sources are unlikely to refer to *pellionella*: the species mentioned might have been *murariella*, *translucens* or *messalina*. Stainton's records from Syria and Asia Minor (1867*a* : 4, 10, 27) are similarly suspect and might also refer to one of these there species. Records from humid tropical regions, notably lowland India and Sri Lanka (Ceylon) (Walker, 1863 : 468, *partim*; Moore, 1887 : 500; Swinhoe & Cotes, 1889 : 703, Fletcher, 1921 : 190) are here considered to be referable to *translucens* as is the major biological study by Cheema (1956 : 167). *Tinea pellionella* is not known from the Neotropical region: Zeller's specimen from Colombia (1877 : 214) is not a member of the *pellionella*-group and the *Tinea* mentioned by Brèthes (1920) is here considered to be *murariella*. All specimens recorded from the Canary Islands and Madeira as *pellionella* by Rebel and Walsingham have been found, on examination, to be *dubiella*: only two records remain unverified (Rebel, 1892 : 269; Walsingham, 1894 : 541) and these probably also refer to *dubiella*. Specimens of '*pellionella*' recorded from Ireland by Bradley (1952) are *flavescentella*. Rebel's record of *pellionella* from Socotra (1907) must be referable to one of the arid-zone species, *murariella* or *messalina*. Zeller's record (1847 : 810) of *pellionella* from Sicily is erroneous: the specimen collected on 4 May is not a member of the *pellionella*-group and the second specimen, collected on 8 May, cannot now be found. Records involving bizarre pabula (Walsh, 1929 : 151; Fletcher, 1933 : 78; Hinton & Greenslade, 1943 : 182) must be considered doubtful in the absence of substantive specimens. I have been unable to confirm the presence of *pellionella* in Japan where *translucens* has been found to be widespread. In the absence of further evidence, I consider all Japanese records of '*pellionella*' to be misidentifications of *translucens*: the records are those of Nagamori (1925), Matsumura (1931), Watanabe (1932), Yamada (1940), Esaki *et alii* (1953), Issiki (1957) and Okano (1959). Silvestri's (1943 : 102) entry for *pellionella* appears, from his figure of the female genitalia, to be referable to *murariella*.

A number of species have, at various times, been erroneously placed in synonymy with *pellionella*, notably *Paratinea merdella* (Zeller) (Dyar, [1903]), *Tinea griseella* Chambers and *Tinea carnariella* Clemens (Walsingham, 1882, and by Fernald, 1882), *Tinea dubiella* Stainton (Stainton, 1874), *Tinea lanella* Pierce & Metcalfe (Agenjo, 1952) and *Tinea tristigmatella* Costa (Tremewan, 1977). *Tinea turicensis* Müller-Rutz was erroneously synonymized with *pellionella* by Müller-Rutz himself (1932 : 263), a synonymy apparently overlooked by subsequent authors while the erroneous synonymy of *dubiella* has been accepted without question up to the present time even though A. S. Corbet dissected a syntype of *dubiella* some time before 1943. Other synonymies have been either overlooked, as in the cases of *zoolegella* Scopoli and *albella* O. G. Costa, or, in the case of *demiurga* Meyrick, never made.

Tinea albella O. G. Costa is a junior primary homonym of *Tinea albella* Thunberg, 1788 (Tremewan, 1977 : 220). In the absence of type-material of *albella* (Hartig, 1939), the synonymy of Stainton (1869 : 267) – that *albella* is probably (Stainton used a '?') a synonym of *pellionella* – should be accepted under the 'first reviser principle'.

This is the '*Tinea flavifrontella*' of certain North American authors who compounded the original misidentification of *Tineola bisselliella* by Packard (1867), an error which persisted despite the efforts of Fernald (1882) and Walsingham (1882) until its last commission by Denton in 1900. The name '*flavifrontella*' probably covered a multitude of sins but *bisselliella* appears to have been the main species involved.

There is a paucity of good illustrations of *pellionella* and its early stages. The best illustrations are those of Réaumur (1737), Rösel von Rosenhof (1746) and de Graaf (1870). American literature contains, in the main, reprinted or copied versions of the illustrations first used by Riley in 1890. The genitalia figures of this species given by Petersen (1957; 1969), Rasmussen (1964) and Hannemann (1977) are helpful and accurate: those given by Căpuşe (1968) are not.

BIOLOGY. This species is capable of utilizing a wide variety of foodstuffs containing keratin in various forms and is, with *Tineola bisselliella*, the agent traditionally responsible for 'moth-damage' to woollen materials in temperate regions. In non-domestic situations, *pellionella* is found feeding on feathers and wool in the nests of a wide variety of birds (see Hicks, 1959 ; 1962; 1971) and has been bred from owl pellets (Bowles, *pers. comm.* – specimen in BMNH). It will feed on the feathers or fur of animal corpses (Prevett, 1954). It has also been bred from fish-meal in Canada (Morris – specimens in BMNH) and may well be able to utilize insect remains (Scopoli, 1763) as can *murariella*. In domestic environments, attacks on woollen material tend to be concentrated on soiled or unwashed wool (Key & Common, 1959); feathers in pillows are eaten and the woollen or horse-hair stuffing or padding of upholstery may be attacked (Back & Cotton, 1931). I recently received larvae of *pellionella* feeding on a carpet composed of 20% wool and 80% synthetic fibre: all fibres had been indiscriminately cut close to the base of the carpet and the wool fibres eaten.

Tinea pellionella is restricted to temperate and cool Mediterranean zones in the Palaearctic and Nearctic regions and is present in Australia and New Zealand. In warmer regions or environments it is replaced as a pest by *translucens*, *murariella* or *dubiella*. It is found in warehouses, stores and outbuildings but is now, in Britain at least, rare in houses and apparently restricted to those which are damp, poorly heated or unoccupied.

Details of the life-cycle of *pellionella* are not well known. Thorough studies are few and some (e.g. Cheema, 1956) do not deal with *pellionella* as claimed. The egg (figured by Titschack, 1922, Pappenheim, 1938 and Chauvin, 1977) takes six to eight days to hatch (Zagulajev, 1960). Case-building activity begins immediately after hatching. The case is made predominantly from silk, with particles of the food substrate and frass attached or adhering. A description of case-building activity is given by Réaumur (1737) whose detailed observations have not been significantly added to or bettered by subsequent authors (see, for example, Butler, 1896). A modern approach to the detailed study of the life-history of this species has been taken by Chauvin in a series of papers (1968–1977). The period of the first instar is seven to ten days (Zagulajev, 1960) and the normal number of larval instars varies from six to eight (Zagulajev, 1960) or six to ten (Chauvin, 1977). The optimal temperature for larval development is 23–25 °C according to Zagulajev (1960); Chauvin (1977) reared his cultures at a temperature fluctuating between 15 and 25 °C and thought 20 °C to be about the optimal temperature. At 25 °C he found that *pellionella* was continuous-brooded with a generation time of about three months, giving a total larval period of about ten weeks and a pupal period of about two weeks. Under natural conditions the generation time is, of course, longer: Chauvin (1977) found *pellionella* to be univoltine in western France but Zagulajev (1960) reported bivoltinism in *pellionella* in the southern U.S.S.R. and univoltinism in the north. Presumably, in the milder conditions of outbuildings or houses two or more generations can occur each year in north temperate regions. The larva of *pellionella* has been described in detail by Hinton (1956). When fully grown, larvae leave the food source and climb upwards and attach their cases to hang from a horizontal surface such as a ceiling (Zagulajev, 1960). Pupation occurs within the case, the pupal period occupying 10–15 days. In a univoltine population, larvae occupy the pupation site in the autumn and pupation does not occur until spring (Zagulajev, 1960). However, according to Lafaury (1886) larvae continue to feed all winter; Ford (1949) records that *pellionella* overwinters as a larva. Shortly before emergence, movements of the pupa occur which, in conjunction with the backward-pointed spines of the pupal abdomen, protrude the head and thorax of the pupa from the larval case; the adult then emerges. Mating occurs on the day of emergence or the next day, usually in the evening (Zagulajev, 1960). Oviposition and oviposition behaviour are described by Zagulajev (1960) and Chauvin (several papers) and fecundity has been studied by Chauvin (1971*b*) and Zagulajev (1960). The period of adult survival is largely dependent upon temperature and humidity and whether or not individuals have mated – Titschack (1922), working with *Tineola*, found that heavy virgin females lived longest, lightweight mated females the shortest.

Apart from the notable exception of Chauvin's studies, little experimental work has been carried out on correctly identified cultures of *pellionella* and some enigmas remain, notably with respect to the tolerance of this species to humidity and temperature. The broad relative humidity tolerance (0–100%) recorded by Chauvin is at odds with the observations of Hartnack (1939) who found that *pellionella* would not develop successfully at a relative humidity of less than 75%. Hartnack's observations accord with mine – I have been unable to keep young larvae of *pellionella* alive at a temperature of 20–25 °C and a relative humidity of 45–55%. Furthermore, *pellionella* is apparently not found in dry, modern centrally-heated houses (in which the humidity is low). Conflict is also to be found in accounts of how *pellionella* overwinters: the reports of Lafaury, Ford and Zagulajev (above) are at variance and may be explicable by regional (climatic) variation.

There is a large amount of literature on the biology of *pellionella* with special reference to economic aspects. Virtually all of these are by authors unaware of the multiplicity of species masquerading as '*pellionella*'. Among the many works listed above, those of Edwards (1889), Herrick (1914) and the several papers by Marlatt, Back and Cotton are particularly useful as is the more modern work by Gradidge *et alii* (1967). An excellent review of modern moth-proofing techniques is given in the *Wool Science Review* (Anonymous, 1965); this paper has also a very good bibliography.

Reports of domestic outbreaks of *pellionella* now seem to be rare in Britain. Between 1970 and 1977, BMNH received a little over 1200 unspecialized enquiries relating to Macro- and Microlepidoptera (excluding Rhopalocera) from the public, commerce and public health departments in Britain. Ten of these involved *pellionella*: nine of the cases involved damage to carpets and the tenth involved damage to felt. The modern scarcity of *pellionella* outbreaks is probably due to a number of factors, among them higher standards of clothing hygiene, the use of synthetic, blended and moth-proofed fabrics, the widespread use of home insecticides and the fact that houses built in the post-war period are often hotter and less humid than older houses. The use of concrete rather than boards and cavities for floors has probably also made a difference to clothes-moth survival as skin dust and fibre fragments in a floor cavity provided a reservoir for infestation.

This species is an obvious candidate for transport by man. The existing populations of *pellionella* in the New World, Australia and New Zealand are here considered to be the result of introduction.

I have not succeeded in rearing *pellionella* in the laboratory although Chauvin (1977) has done so successfully, using pelts of musk-rat and small mammals (e.g. *Clethrionomys*) as a food source.

Attention is drawn here to the major study of the ecology of *pellionella* in a bulk wool store in Australia by Key & Common (1959).

PARASITES. Ichneumonidae: *Gelis cinctus* (L.) – W. Europe (det. Fitton, Robinson; Richards, 1949), *Hypsicera curvator* F. – N. America, W. Europe (Riley, 1890–1; Morley, 1930; Thompson, 1947; Richards, 1949; Woodroffe & Southgate, 1951*a*).

Braconidae: *Apanteles carpatus* (Say) – N. America, W. Europe (Marlatt, 1915; Ferrière, 1941; Burks, 1943; Thomson 1947; Woodroffe & Southgate, 1951*a*; Nixon, 1976), *Chremylus rubiginosus* (Nees) – N. America, W. Europe (Bruneteau, 1930; Morley & Rait-Smith, 1933; Thompson, 1947; Mason, 1948).

Pteromalidae: *Habrocytus semotus* (Walker) – W. Europe (Voukassovitch & Voukassovitch, 1931 – suggested to be *semotus* by Dr Z. Bouček).

Chalcidae: *Tetrastichus tineivorus* Ferrière [hyperparasite on *Apanteles carpatus*] – N. America (Burks, 1943 – as *T. carpatus* Burks).

The parasite records by Nagamori (1925) and Watanabe (1932) are considered to refer to *translucens* (q.v.) and the record by Brèthes (1920) is considered to refer to *murariella* (q.v.).

DISTRIBUTION. (Fig. 77.) Great Britain, France, Corsica, Germany, Austria, Switzerland, Italy, U.S.S.R. (European Region), India (highlands only), Sikkim, New Zealand, Canada, U.S.A. The following additional locality records from modern literature are here accepted as reliable: Norway, Sweden, Denmark, Finland (Rasmussen, 1964; Opheim, 1965; Krogerus *et alii*, 1971), Poland (Razowski & Sliwiński, 1961), Spain (Petersen, 1960; 1964*d*), Rumania (Căpuşe, 1968), Hungary (Gozmány & Szőcs, 1965), Yugoslavia (Klimesch, 1968), Greece (Klimesch, 1968), U.S.S.R. (Ukraine, Caucasus) (Zagulajev, 1960), Mongolia (Zagulajev, 1972), China (Sinkiang) (Zagulajev, 1960), Australia (Key & Common, 1959). Records of *pellionella* from countries other than those listed above are considered unreliable or unproven: records from Syria, Asia Minor, Socotra, Madeira, the Canary Islands, lowland India, Sri Lanka (Ceylon) and Japan are specifically rejected (see 'Remarks').

MATERIAL EXAMINED

191 ex. (68 ♂, 46 ♀ genitalia preparations), living and preserved larvae, cases and pupae, one laboratory culture (from G. Chauvin).

Great Britain: 3 ex., Isle of Wight, Niton, 10.vii.1930 (*Fletcher*); 1 ♂, Hampshire, New Forest, Brockenhurst, 21.viii.1930 (*Fletcher*); 6 ex., Hampshire, Southampton, various dates 1932–1937 (*Fassnidge*); 1 ♂, Sussex, Tilgate, 24.vii.1922 (*Gardner*); 1 ♀, Sussex, Southbourne, 5.ix.1919 (*Gardner*); 1 ♂, Surrey, Mickleham, 5.vii.1853 (*Stainton*); 1 ♂, 1 ♀, Surrey, Redhill, 13.vii., 23.viii.1935 (*Rait-Smith*); 12 ex., Greater London, Bromley, various dates 1930–1947 (*Jacobs*); 5 ♀, Greater London, Bexley, various dates 1922–1931 (*Ford*); 1 ex., Greater London, Dartford Heath, 27.vi.1849 (*Stainton*); 1 ♀, Greater London, Richmond Park, Sidmouth Plantn, bred from nest of heron, 27.iv.1935 (*Collenette*); 1 ♂, Greater London, Richmond Park, 15.viii.1948 (*Bradley*); 1 ♀, 1 ♂, Greater London, Lewisham, 30.v.1880, vii.1887 (*Stainton*); 2 ex., Greater London, S.W.1, Eaton Square, 8.vii.1887; 3 ex., Greater London, W.11, Ladbroke Square, *c.* 1950 (*Meinertzhagen*); 3 ♂, Greater London, Ilford, vi.1974, 14, 15.vi.1975 (*Robinson*); 1 ♂, Greater London, Rainham, 10.vi.1976 (*Robinson*); 1 ♀, Essex, Maldon, ex 20% wool carpet, viii.1977 (*Sandford*); 1 ♂, Essex, Southend, 10.vii.1910 (*Whittle*); 9 ex., Gloucestershire, Stroud, various dates 1936–1942 (including 3 bred from birds' nests) (*Fletcher*); 1 ♀, Cambridgeshire, Chatteris, ex stuffed grebe, 6.vii.1921 (*Fryer*); 42 ex., Norfolk, Merton, various dates 1891–1907 (*Walsingham, Durrant*); 1 ♂, Northamptonshire, Clapton, 30.vi.1917 (*Gardner*); 1 ♂, Merseyside, Liverpool, 3.vii.1918 (*Tyerman*); 1 ♀, Cheshire, Sandbach, ex owl pellet, iii–iv.1976 (*Bowles*); 1 ♀, South Yorkshire, Sheffield, 20.vii.1848 (*Stainton*); 1 ♀, Tayside region, Pitlochry, 26.viii.1884 (*Stainton*); 1 ex., Tayside region, Blair Atholl, 13.vii.1882 (*Stainton*); 1 ♂, Highland region, Aviemore, 30.vi.1908 (*Bankes*); 1 ♂, Highland region, Lochinver, 7.viii.1921 (*Whittle*). **France**: 7 ex., Basses Pyrénées, St Pierre d'Irube, various dates 1936–1938 (*Adkin*); 1 ♂, Basses Pyrénées, Le Lac, St Jean de Luz, 1.vi.1931 (*Muspratt*). **Corsica**: 1 ♂, Bocognano, vi.1905 (*L.*). **Germany (West)**: 1 ♂, Köln, 10.viii.1892. **Germany (East)**: 8 ex., Grünhof, various dates 1870–1877 (*Zeller*); 1 ♂, Sömmerda [*Wocke*]. **Austria**: 1 ♀, Klosterneuburg, in garden, 1.vi.1915 (NM, Vienna); 1 ♀, Linz, 18.iv.1923 (*Knitschke*) (NM, Vienna); 1 ♂, Untersteiermark, Sanntaler Alps, Logar Valley, 7–900 m, 11–20.vii.1942 (*Zerny*) (NM, Vienna). **Switzerland**: 1 ♂, Montreux, 10.vii.1926 (*Fletcher*); 1 ♂, Bernese Alps, Grimmialp, 1225 m, 7.vii.1925 (*Fletcher*); 2 ex., Bergün, 26.vii.1873 [*Zeller*]; 1 ♂, Engadin (*Frey*). **Italy**: 1 ♀, Toscana (*Fischer von Röslerstamm*). **U.S.S.R.** (European region): 3 ex., Kola Peninsula, Murmansk, Yukanski, 4, 18.viii.1917 (1 ex. 'on cottongrass') (*Cockayne*); 2 ex., Latvia ('Livon.') [*Lienig*]. **India**: 18 ex., Assam, Shillong, 1525 m, various dates 1918–1928 (including 1 ♀ paralectotype of *demiurga*)

(*Fletcher*). **Sikkim**: 2 ♂, Gangtok, 1850 m, v, 3.vi.1928 (*Bailey*). **New Zealand**: 2 ♂, Nelson, 26.–.1923, 11.xii.1924 (*Philpott*) (1 ♂ in MARC, Auckland); 2 ♂, 1 ♀, Tisbury, 23.xi.1919, 29.i., 4.ii.1920 (MARC, Auckland); 1 ♂, Wellington, 31.xii.1879 (*Meyrick*). **Canada**: 2 ex., Newfoundland, St John's, ex fish meal, 13.xii.1961 (*Morris*); 4 ex., Newfoundland, Burgeo, ex fish meal, 27.iv., 17.v.1961 (*Morris*). **U.S.A.**: 1 ♂, Washington, Pullman, 9.viii.1932 (*Clarke*) (NMNH, Washington); 1 ♂, 3 ♀, Connecticut, New London, ex feather pillow, vi.1925 (*Back*) (NMNH, Washington); 1 ♂, California, Alameda County, 22.v.1908 (*Pilate*) (NMNH, Washington). 11 ex., no locality data, ex Zeller, Brown, Doubleday, Walsingham and Tyerman collections, BMNH.

Tinea translucens Meyrick
(Figs 1–3, 5, 7, 9, 11, 18–20, 31, 44, 51, 59, 78, 87–89, 102)

Tinea translucens Meyrick, 1917, *Exot. Microlepidopt.* **2**: 78. Holotype ♀, PAKISTAN: Peshawar, v.1916 (*Fletcher*) (genitalia slide no. 13310; BMNH) [examined].

Tinea metonella Pierce & Metcalfe, 1934, *Entomologist* **67**: 266. LECTOTYPE ♂ (abdomen and genitalia only), GREAT BRITAIN: Merseyside, Liverpool, [wool warehouse, 11 or 14.vii.1856] (*Cooke*) (genitalia slide no. Pierce 3206; BMNH), here designated [examined]. **Syn. n.**

Tinea leonhardi Petersen, 1957, *Beitr. Ent.* **7**: 146, fig. 111. Holotype ♂, YUGOSLAVIA: Dalmatia, Castelnuovo, 3–11.v.1910 (*Leonhard*) (IP, Eberswalde) [not examined]. **Syn. n.**

Tinea margaritacea Gozmány, 1967, *Annls Mus. r. Afr. cent.* **157**: 14, fig. 13. Holotype ♂, ZAIRE: Lubumbashi [Elisabethville], iii.1936 (*Seydel*) (genitalia slide no. T-01; MRAC, Tervuren) [examined]. **Syn. n.**

Tinea fortificata Gozmány, 1968, *Acta zool. hung.* **14**: 302, figs 2, 11. Holotype ♂, SOUTH AFRICA: Transvaal, Pretoria, 8.iii.1909 (*Janse*) (genitalia slide no. 14177; BMNH) [examined]. **Syn. n.**

Tinea metonella Pierce & Metcalfe; Pierce & Metcalfe, 1935: 95, pl. 58 [♂, ♀ genitalia]; Corbet & Tams, 1943*b*: 111, 143, figs 230, 257, 285, pl. 5, fig. 28 [identification; distribution; biology]; Ford, 1949: 184 [biology]; Bradley, 1966*a*: 217 [*leonhardi* synonymized]; Petersen, 1968: 98 [Germany (West); *leonhardi* synonymized; *metonella* removed from synonymy with *turicensis*]; Petersen, 1969: 374, figs 151, 160, 168 [♂, ♀ genitalia; biology; distribution; Germany (East) – Naumburg, Meissen]; Petersen, 1973*a*: 69 [Afghanistan]; Adams & Jacob, 1975: 7 [discovery in Britain – inaccurate account]; Hannemann, 1977: 220, pl. 17, fig. 9, figs 119a–b [identification; distribution; Germany (East)].

Tinea leonhardi Petersen; Petersen, 1959*a*: 568 [Afghanistan; ♂ genitalia]; Petersen, 1959*b*: 156 [Syria]; Zagulajev, 1960: 166, figs 128, 129 [U.S.S.R. – Caucasus, Turkmenia; description; ♂ genitalia]; Petersen, 1961*b*: 58 [Germany (East)]; Petersen, 1962: 201 [Yugoslavia, Malta]; Petersen, 1963*a*: 187 [Afghanistan]; Petersen, 1963*c*: 12 [Albania]; Petersen, 1964*a*: 116 [Iran]; Petersen, 1964*c*: 121 [Germany]; Căpuşe, 1968: 323 [Rumania; ♂ genitalia].

Tinea margaritacea Gozmány; Gozmány & Vári, 1973: 50, fig. 109 [redescription].

Tinea fortificata Gozmány; Gozmány & Vári, 1973: 50, figs 105, 106 [redescription].

[*Tinea pellionella* L.; Zeller, 1852: 157 (*partim* – 1 ♂, 2 ♀ and 'var. b' only); Walker, 1863: 468 (*partim* – specimens from Ceylon only); Moore, 1887: 500 [Ceylon]; Swinhoe & Cotes, 1889: 703 [Ceylon]; Meyrick, 1909: 361 [South Africa]; Fletcher, 1921: 190, pl. 56, fig. 2 [India]; Nagamori, 1925: 349 [Japan; parasite]; Matsumura, 1931: 1108, fig. [Japan]; Watanabe, 1932: 98 [Japan; parasite]; Yamada, 1940: 14 [Japan; biology]; Esaki *et alii*, 1953: 440, fig. 1184 [Japan]; Cheema, 1956: 167 [India; detailed study of biology]; Issiki, 1957: 16, pl. 2, fig. 41 [Japan; colour figure]; Okano, 1959: 276, pl. 182, fig. 30 [Japan; colour figure]. Misidentifications.]

[*Tinea merdella* Zeller; Cooke, 1856: 125 [first British record]; Stainton, 1857: 102 [description]. Misidentifications.]

[*Tinea pachyspila* Meyrick; Fletcher, 1914: 466, fig. 342 [poor figures of case, pupa and adult; India]. Misidentification.]

[*Tinea turicensis* Müller-Rutz; Zagulajev, 1960: 164, figs 126, 127 [U.S.S.R. – Caucasus; ♀ genitalia]; Căpuşe, 1968: 328, figs 171B, 171C (*partim* – ♀ only) [Rumania; ♀ genitalia]. Misidentifications.]

♂ (Fig. 87). 9–14 mm. Head light ochre. Maxillary palpus whitish, extending to just beyond second segment of labial palpus. Labial palpus ochreous white, densely flecked with blackish brown scales on outer surface. Galea extending to base of second segment of labial palpus. Antenna greyish brown, four-fifths length of fore wing. Thorax and tegula ochre, dusted with deep grey anteriorly. Fore wing ochreous, fringes concolorous, with distinct but diffuse basal fascia of dark grey scales, particularly dark at costa. Discal and plical spots small, elongate, dark grey; discocellular spot small, charcoal-grey. Hind wing ochreous white with a slight grey tint. Legs ochreous, fore leg and base of middle tibia grey above. Abdomen greyish ochre.

♀ (Figs 88, 89 [aberrant]). 11–18 mm. Coloration as ♂.

GENITALIA ♂. Saccus elongate, 0·94 ± 0·19 mm long. Valva (Fig. 44) with costa often markedly concave, apex rounded or slightly truncated at costal margin. Dorsal margin of gnathos concave, tip upturned towards tip of uncus. Anellus spines (Fig. 31) of rather variable form, commonly arranged in a broad, elongate band of twenty or more small spines. Aedeagus (Figs 18–20) elongate, 1·47 ± 0·27 mm long; tip without carinae; vesica with pair of distinctly blunt-tipped blade-shaped cornuti and at least four small, elongate terminal cornuti. In some individuals, small cornuti connected by zone of sclerotization to wall of aedeagus [see 'Morphology']. In specimens from Japan, number of terminal cornuti often very large, frequently exceeding ten. Aedeagus/saccus ratio 1·58 ± 0·35.

GENITALIA ♀. Eighth sternite with deep, narrow V-shaped emargination and distinct sclerotized lateral patches at base of emargination (Fig. 59). Posterior region of antrum with rhomboidal outline, transverse folds of wall convergent at ostium; longitudinal folds transversely divided in posterior half. Anterior limit of antrum with more or less clearly-defined annular sclerotization appearing as transverse stripes at posterior end of ductus bursae. Corpus bursae (Fig. 51) with two conspicuous needle-shaped signa, each arising from one side of a short, broad, blade-shaped base set in large, circular sclerotized base-plate. Sclerotization of signum base-plates uneven, giving each base-plate irregular edge and mottled appearance.

REMARKS. *Tinea translucens* closely resembles *pellionella* in its external characteristics and cannot be reliably separated from it except by examination of the genitalia. The two large cornuti of the male are blunter than in *pellionella* which also lacks the apical group of small cornuti always present in *translucens*. The dorsal margin of the gnathos is concave, not straight as in *pellionella* and the aedeagus is straight whereas in *pellionella* it is distinctly banana-shaped. Females of *translucens* have a much larger antrum than females of *pellionella* and the eighth sternite is more deeply emarginate. The signa, apparently always a pair in *translucens*, are frequently more numerous in *pellionella*: the signum base-plates of *pellionella* do not have the characteristic irregular edge and mottled appearance of those of *translucens* and the bases of the needle-shaped signa are usually shorter and broader in *pellionella* than in *translucens*.

Specimens of *translucens* from Japan, while agreeing with material from elsewhere in all other characteristics, have a larger number of small cornuti at the tip of the aedeagus, usually about twelve, whereas non-Japanese specimens have about half this number.

The specimen illustrated in Fig. 89 is aberrantly marked, having a dense basal field of blackish scales in the fore wing.

Previous workers on this group have overlooked entirely the existence of the name *translucens* and the holotype in BMNH. This is due to the cryptic nature of the original description and the state of the holotype which is flecked with particles of carbon and is slightly greasy.

The placing of *Tinea metonella* Pierce & Metcalfe as an erroneous synonym of *Tinea turicensis* Müller-Rutz by Petersen (1957 : 148 *et seq.*) and Rasmussen (1964 : 337) occurred because these authors both examined the male genitalia preparation of *dubiella* in the Pierce collection (Pierce slide no. 3208; BMNH) labelled '*metonella*'. Pierce's slide 3206, clearly labelled 'TYPE/Cooke Col. Liverpool' is a specimen of *translucens* and there is no evidence that slide no. 3208 is a syntype. This error of identification was corrected by Bradley (1966*a* : 217) and the correction followed by Petersen (1968 : 98 *et seq.*). Petersen had already, however, described *leonhardi*, having been misled by being provided with the wrong slide from the Pierce collection. Petersen's misidentification was followed by Zagulajev (1960 : 164) who complicated matters further by figuring the female genitalia of *translucens* as *turicensis*. Gozmány's two further synonyms of *translucens* are each based on specimens of both sexes: the original descriptions are accompanied by figures of remarkable crudity.

The description of '*Tinea metonella*' by Kudrjavtseva (1975 : 621, figs 3A, 3B) is here considered to refer to *murariella*. She illustrates and mentions the fairly frequent occurrence of a group of three signa: I have seen no example of *translucens* with three signa whereas in *murariella* about 20% of individuals examined have three signa.

Tinea translucens is the '*Tinea merdella* Zeller' of Cooke (1856) and Stainton (1857): the description by the latter author has been traditionally attributed to *Tinea flavescentella* Haworth (q.v.) but is based on Cooke's specimens which are *translucens*.

BIOLOGY. This species appears to be able to utilize much the same range of foodstuffs as *pellionella* which it replaces in warmer climates, filling the same synanthropic niche. *Tinea translucens* has been consistently misidentified as *pellionella* in the humid tropics and appears to be the primary agent responsible for moth damage in these areas. There are no records of *translucens* being found (except as an adult) in non-domestic circumstances. Specimens have been bred from woollen clothing, 'oriental' carpets, blankets, a leather shield and from bongo drums made from zebra-skin. Silk headbands of books imported from Malaysia were found to have been damaged by a case-bearing larva which I consider to have been of this species. In the laboratory, *translucens* will feed on feathers, wool, leather and fish-meal; large larvae are able to eat hair as coarse as that of a human beard.

Tinea translucens is a cosmopolitan species which is apparently common in the humid tropics. It ranges northward as far as Virginia (U.S.A.), Liverpool (England) and Tokyo (Japan) and southward as far as Quillota (Chile) and Cape Town (South Africa) but at its latitudinal extremes, in the north at least, it is entirely restricted to a synanthropic indoor existence in artificial warmth and shelter.

I consider that the study of the bionomics of '*Tinea pellionella*' published by Cheema (1956) is really of this species. The source of Cheema's material was Kanpur, Uttar Pradesh, India, well out of the range of *pellionella* and well within the range of *translucens*. Cheema found that eggs hatched after an incubation period of four to seven days but hatching only occurred at temperatures between 21 and 32 °C: outside this range all eggs died. Cheema's measurements of the length and width of newly hatched larvae are remarkable for their degree of precision (to 0·001 mm) and it would be of interest to know the technique used for such measurements: the figures given for standard error are equally remarkable (less than 1·5% of the mean) and may represent a typographic error. Larvae developed satisfactorily at 21–32·5 °C and died at temperatures outside this range. Fastest development (33 days from hatching to pupation) occurred at 25 °C and 90% R.H. The comments above regarding newly-hatched larvae are also applicable to Cheema's measurements of fully grown larvae. Larvae passed through five to twelve instars, five instars being observed in all larvae reared at 25 °C and the larger numbers of instars occurred at the highest non-lethal temperatures. The pupal period was found to be about 10 days at 25 °C. Copulation (lasting about 30 minutes) was found to occur within 12 hours of emergence, oviposition beginning a day and a half later and continuing for about four days. Females were found to lay between eight and 83 eggs, larger females laying more eggs than small females. Adult life-spans were found to be in the range of three to seven days, rather short compared with those recorded for *Tineola* by Titschack (1920). Males were shorter-lived than females (the contrary was found in *Tineola*). The cultures used in Cheema's experiments yielded a predominance of females (which were more than twice as abundant as males) and this may account for the phenomenon of reduced male longevity, it being possibly caused by multiple copulation (Titschack found that copulation reduced male longevity in *Tineola*).

Cheema's observations accord closely with mine. Six laboratory cultures of *translucens* are currently maintained in BMNH; one of these was obtained in 1973, and the others are more recent acquisitions. Cultures are stored at a temperature of about 25 °C in which the generation time is about three months. The behaviour of all stages seems similar to that observed by other authors in *pellionella* but Cheema records and I confirm that case-building does not begin immediately after hatching: newly hatched larvae wander a great deal before they begin case-building and feeding, and this dispersive first day of larval life is a problem with cultured material as larvae are able to pass through very narrow apertures and escape from most types of container.

Since the beginning of 1970, BMNH has received 15 reports of outbreaks of *Tinea translucens* in Britain (for details of enquiries, see p. 77, 'Biology' of *pellionella*). Thirteen of these outbreaks involved damage to zebra-skin bongo drums imported into Britain from East Africa or South Africa and in several cases infestation had spread from the drums to carpets or clothing. The fourteenth outbreak involved a souvenir 'Zulu' shield from East Africa (damage to leather and hair) and the fifteenth was a large outbreak in a shop selling woollen goods imported from Peru. In all cases, outbreaks occurred in warm buildings with central heating, conditions in which *pellionella* is rarely found.

Carriage and importation of *translucens* by man seems to be frequent as exemplified by its recent outbreaks in Britain. Further examples were intercepted by the Ministry of Agriculture, Fisheries and Food in 1976 in a cargo of Argentinian sheepskins imported into Britain. The type-series of *metonella* was found in a warehouse with imported wool.

Tinea translucens is, with *Tinea murariella*, extremely simple to rear in the laboratory and, with suitable safeguards taken to prevent pest outbreaks, is a potentially valuable laboratory animal for use in education. Our cultures are set up in transparent plastic boxes (12 × 18 cm and 6 cm deep) with tight-fitting lids. The boxes are sealed with adhesive tape to prevent the escape of newly hatched larvae. The food provided is old woollen clothing (socks or pullovers cut into small strips) sprinkled with fishmeal containing 10% yeast powder. After several generations the contents of the box are reduced to a layer of frass topped with a layer of old larval cases and adult bodies. Living larvae will recycle their ancestors and their cases for a while, producing dwarfed adults which appear to have a longer development time than adults which, as larvae, were provided with fresh food. Cultures reduced to this condition will maintain themselves for only a short time and subcultures should be established in a new box with fresh food. We usually manipulate our cultures of this species during the winter when they can be taken outdoors and cooled so that adults do not move and there is little danger of producing secondary infestations.

PARASITES. Ichneumonidae: *Hypsicera curvator* F. – W. Europe (det. Fitton, Robinson).

Braconidae: *Apanteles carpatus* (Say) – Japan (Watanabe, 1932 – as *A. igae* Watanabe on '*pellionella*'), *Chremylus rubiginosus* (Nees) – Japan (Nagamori, 1925 – as *Paramesocrina tineavora* Nagamori on '*pellionella*').

DISTRIBUTION. (Fig. 78.) Great Britain, Germany (East), Austria, Sicily, U.S.S.R. (S. Russia), Tunisia, Egypt, Pakistan, India, Kashmir, Sri Lanka, Japan, Zaire, Rhodesia, South Africa, U.S.A., Chile. The following additional locality records from the literature are here accepted as reliable: Germany (Petersen, 1968), Malta (Petersen, 1962), Rumania (Căpuşe, 1968), Albania (Petersen, 1963*c*), Yugoslavia (Petersen, 1957), U.S.S.R. (Turkmenistan) (Zagulajev, 1960), Syria (Petersen, 1959*b*), Iran (Petersen, 1964*a*), Afghanistan (Petersen, 1963*a*).

MATERIAL EXAMINED

388 ex. (46 ♂, 38 ♀ genitalia preparations), living and preserved larvae, cases and pupae (including laboratory cultures).

Great Britain: 32 ex., Isle of Wight, Yarmouth, ex African hide drum, culture 1, 1974; 60 ex., Greater London, Staines, ex hide drum from S. Africa, culture 2, 1974; 64 ex., Berkshire, Slough, Pest Infestation Control Laboratory stock, ex African hide drum, culture 3, 1974; 43 ex., Sussex, Horsham, ex Kenyan drum, culture 4, 1975; 60 ex., Greater London, S.W.1, ex woollens from Peru, BMNH culture, 1975; 42 ex., 4 cases with pupae, Essex, Basildon, ex African drums, BMNH culture 6, 1977; 2 ex., Greater London, Staines, ex skin drum from South Africa purchased vii.1973, emerged 7.i.1974 (*Pestridge*) [same source as culture 2]; 2 ex., ex larva on E. African bongo drums, 1974; 16 ex., Greater London, W.8, Commonwealth Institute, from W. Indian ceremonial dress, 16.ix.1965 (*Bradley*); 1 ♀ (abdomen and genitalia only), data as lectotype of *metonella* (Pierce slide no. 3206; BMNH) (paralectotype of *metonella*). **Germany (East)**: 3 ♂, 1 ♀, Grünhof, 15., 24.vi.1872 (*Zeller*); 1 ♀, Ober-Lausitz, Niesky, 19.vi.1857 (*Christoph*). **Austria**: 1 ♂, 1 ♀, Wien, ex larva, 14.vi.1889 (*Hornig*) (NM, Vienna); 1 ♀, Linz, 18.iv.1923 (*Knitschke*) (NM, Vienna). **Sicily**: 1 ♂, Siracusa, 8.v.[1844] (*Zeller*). **U.S.S.R.** (S. Russia): 1 ♀, Krasnoarmeysk ('Sarepta'), 13–14.viii.1858 (*Christoph*). **Tunisia**: 1 ♂, Sfax, 6.vi.1950 (*Bédé*). **Egypt**: 1 ♀, Siwa, 26.iv.1935 (*Omer-Cooper*). **India**: 2 ♀, Uttar Pradesh, Dehra Dun, ix.1931, 6.viii.1936 (*B. Graham*); 1 ♀, Punjab, Seraj Range, 9.ix.1923 (*R. O.*); 1 ♂, Uttar Pradesh, Kumaun, Mukteswar, 2125 m, 8.v.1923 (*Fletcher*); 2 ♀, Madras, Coimbatore, 5.xi.1913, ix.1916 (*Fletcher*); 2 ex., Madras, Coimbatore, bred from woollen clothes, 24.viii.1916 (*Ramakrishna*); 1 ♂, Uttar Pradesh, Naini Tal, 2000 m, 12.vi.1934 (*Graham*); 1 ♂, Madras, Shevaroy Hills, 1375 m, xii.1913 (*Fletcher*); 2 ♂, Punjab, Simla, v.1918 (*Fletcher*); 6 ex., Bengal, Bihar, Pusa, iii, iv.1912 (bred from wool), 23.ii.1923, 28.x.1923 (feeding on blanket) (*Fletcher*). **Kashmir**: 1 ♀, Srinagar, 1575 m, 2.x.1923 (*Fletcher*). **Sri Lanka**: 7 ♂, 4 ♀, Kan district, Kandy, ex Persian carpet, iii.1970 (*Pereira*) (NMNH, Washington). **Japan**: 2 ♂, Tokyo, 13.vi, 14.vii.1932 (*Issiki*) (1 ♂ in NMNH, Washington); 1 ♂, Taihoku, 19.xi.1933 (*Issiki*) (NMNH, Washington); 1 ♂, Honsyû, Osaka, 11.vii.1954 (*Issiki*) (NMNH, Washington); 2 ♀, Honsyû, Osaka, ex wool, 20.xi.1971 (*Moriuti*); 2 ♂, 2 ♀, Honsyû, Osaka, Moriguti, 10, 19.x.1973 (*Saito*) (1 ♂, 1 ♀ in UOP, Osaka); 6 ex., Honsyû, Osaka, Moriguti, 15–19.iv.1974 (*Saito*) (2 ex. in UOP, Osaka). **Rhodesia**: 5 ex., Salisbury, 1894 (*Marshall*).

South Africa: 1 ♀, Cape Province, Simonstown, 1946 (*Hunt*); 2 ex., Natal, 3, 4.v.1879 (*Wocke*); 1 ♂, Capetown, 1907 (L.). **Africa**: Mam'a, iii.1872 (*Christoph*). **U.S.A.**: 2 ♂, 2 ♀, Virginia, McLean, ex leather shield, 8.vi.1970 (*Davis*) (NMNH, Washington). **Chile**: 2 ♂, Quillota, i. (*Silva*) (NMNH, Washington). **Incomplete Data**: 1 ♀, 'Pellionella L., Z.L.E. [Zeller – Linn. ent.] 6: 157' / Zeller Coll.; 1 ♀, 'Wshtr. lit. X.48' [Wiesenhütter – letter of October 1848] / Zeller Coll.; 1 ♂, 'Pellionella var. b. H.15. [Hübner fig. 15] H.S. 278 [Herrich-Schäffer fig. 278]' / Zeller Coll.

Tinea murariella Staudinger

(Figs 1, 2, 10, 21–23, 32, 33, 45, 52, 60, 79, 90, 91)

Tinea murariella Staudinger, 1859, *Stettin. ent. Ztg* **20**: 235. Lectotype ♀, SPAIN: Cadiz, Chiclana, bred from chalk and dust cases on house walls, 5 May (*Staudinger*) (genitalia slide [Agenjo]; MNHU, Berlin), designated (as holotype) by Agenjo (1952: 345) [examined].

Tineola bipunctella Ragonot, 1874, *Bull. Soc. ent. Fr.* **1874**: clxxi. LECTOTYPE ♀, SPAIN: Barcelona, bred from debris of *Charaxes* wings, 25.vi.1871 (genitalia slide no. 2402 [Viette]; MNHN, Paris), here designated [examined]. [Synonymized by Amsel (1955: 63).]

Tinea murariella Staudinger; Wocke, 1861: 107 [catalogue]; Stainton, 1869: 143 [description]; Wocke, 1871: 270 [catalogue]; Hofmann, 1875: 71 [Spain – Andalusia]; Seebold, 1879: 125 [Spain – Bilbao]; Seebold, 1898: 162 [Spain – Bilbao]; Rebel, 1901: 240 [Spain; Sicily; Yugoslavia]; Zerny, 1927: 486 [Spain – Albarracín]; Kautz, 1928: (76) [Spain – Andalusia]; Müller-Rutz, 1932: 263 [Switzerland – as *Tineola murariella*]; Agenjo, 1952: 62, pl. 9, figs 2, 2a, 2b, 3 [description; ♂ genitalia; Spain]; Amsel, 1955: 63, pl. 6, fig. 7 [*bipunctella* synonymized; ♂ genitalia; Spain]; Petersen, 1957: 149, fig. 115 [♀ genitalia]; Petersen, 1959*a*: 569, fig. 14 [♂ genitalia]; Petersen, 1960: 227 [Spain]; Lhomme, 1963: 1100 [France]; Petersen, 1963*b*: 414 [bred from raptor pellets, Sudan]; Petersen 1964*d*: 404, 417 [Spain]; Petersen, 1967: 358 [Spain]; Căpuşe, 1968: 334, figs 174, 175A–D [Rumania]; Hicks, 1971: 178 [erroneous birds' nest record]; Chauvin, 1977: 1 [detailed and important study of biology; comparison with *pellionella*].

Tineola bipunctella Ragonot; Ragonot, 1875: 579, pl. 11, fig. 1 [description; figure]; Rebel, 1896: 125 [Canary Is]; Rebel, 1901: 240 [Spain; Mauretania; Tenerife]; Walsingham, 1908: 1026 [North Africa; Canary Is]; Rebel, 1910: 367 [Canary Is]; Rebel, 1917: 62 [Tenerife]; Kautz, 1928: (76) [Andalusia]; Amsel, 1955: 63 [synonymized with *murariella*].

[*Tinea pellionella* L.; Stainton, 1867*a*: 4, 10, 27 [Syria; Asia Minor; reference to *murariella* doubtful – specimens not seen]; Rebel, 1907: 99 [Socotra; reference to *murariella* doubtful – specimen not seen]; Brèthes, 1920: 286 [Argentina; parasite]; Silvestri, 1943: 102, figs 121–126 [biology]; Biezanko *et alii*, 1957: 16 [Uruguay]. Misidentifications.]

[*Tinea metonella* Pierce & Metcalfe; Kudrjavtseva, 1975: 621, fig. 3 [U.S.S.R. – Adzhar; development times]. Misidentification.]

♂ (Fig. 90). 8–12 mm. Head yellow-ochre. Maxillary palpus whitish, almost reaching tip of second segment of labial palpus. Labial palpus ochreous, whitish on inner surface, outer surface flecked with greyish brown. Galea reaching one-third length of second segment of labial palpus. Antenna dark greyish brown, almost reaching apex of fore wing. Thorax and tegulae yellow-ochre, greyish brown anteriorly. Fore wing light yellow to greyish ochre, fringes concolorous, base of costa greyish brown. Discocellular spot small, brown to dark grey-brown; discal and plical spots ill-defined or obsolete in pale specimens (with high magnification a few dark plical scales can usually be found) but well-defined in dark specimens. Hind wing pale greyish, fringes paler, ochreous cream. Legs cream to ochreous, fore legs dusted above with dull brown. Abdomen light greyish brown.

♀ (Fig. 91). 11–17 mm. Coloration as ♂.

GENITALIA ♂. Saccus elongate, 0·89 ± 0·18 mm long. Valva (Fig. 45) with apex rounded or slightly truncated at costa. Dorsal margin of gnathos straight in middle, concave at base and tip. Anellus spines (Figs 32, 33) small and flat, forming an elongate row three or four spines wide; about 20 spines in each row heavily sclerotized; unsclerotized plaques extend distally along anellus almost to level of tip of gnathos (when anellus fully 'unrolled' posteriorly after removal of aedeagus). Aedeagus (Figs 21–23) 1·33 ± 0·27 mm long; tip without carinae; vesica ornamented only with two blade-shaped cornuti: tips of cornuti acutely pointed, diagonal edge usually coarsely serrate with one or two lateral spine-like projections. [In one example seen, tips of cornuti are smooth and tapered – Fig. 23.] Aedeagus/saccus ratio 1·51 ± 0·12.

GENITALIA ♀. Eighth sternite with deep, narrow V-shaped emargination (Fig. 60). Posterior region of antrum swollen equatorially at level of transverse folds which do not converge towards ostium; longitudinal folds transversely divided in anterior half. Anterior limit of antrum with clearly defined annular sclerotization appearing as transverse stripes at end of antrum. Corpus bursae (Fig. 52) with two or three conspicuous needle-shaped signa, each arising from one side of a short, broad, blade-shaped base set in a large, circular, well-sclerotized base-plate. Sclerotization of signum base-plate even, giving each base-plate regular edge and evenly coloured appearance.

REMARKS. *Tinea murariella* closely resembles *T. translucens* both in external appearance and in genital structure, particularly of the female. The discal and plical spots are usually not as well developed as in *translucens* and the colour of the fore wings is generally lighter. There are no carinae on the aedeagus of *murariella* and the vesica is ornamented only with two large blade-shaped cornuti: the serrated tips of these cornuti are characteristic but not always present. The small terminal cornuti of *translucens* are always absent in *murariella*. Females of *murariella* may have two or three signa – *translucens* always has two – and these are set in base-plates which are evenly and densely sclerotized: in *translucens* the base-plates have mottled sclerotization, which gives them an irregular edge. Transverse division of the longitudinal antrum folds occurs much further anteriorly in *murariella* than in *translucens* and the transverse folds in the posterior (swollen) region of the antrum do not converge on the ostium as in *translucens*. In *murariella* there is a small longitudinal mark at either side of the anterior end of the emargination of the eighth sternite: this is a small fold in the inner wall of the antrum and is absent in *translucens*.

The fore wing colour of laboratory-reared specimens of *murariella* is comparable with that of *translucens* but wild-caught specimens are generally paler and may be quite bright pale yellow. The density of fore wing coloration is more variable in *murariella* than in other species of the *pellionella*-group.

The males referred to by Ragonot (1875 : 579) are not syntypes as they were obtained after the publication of the original description. The female designated here as lectotype may have been the only specimen described by Ragonot in 1874 – his description makes no mention of the number of specimens he had. There are now no specimens of *bipunctella* in the Ragonot collection apart from the lectotype (Viette – *pers. comm.*).

The illustrations and description of Silvestri (1943 : 102) are here considered to refer to *murariella* and not *pellionella* and the record of '*Tinea metonella*' by Kudrjavtseva (1975) is also considered to be of this species. The records of '*pellionella*' by Stainton (1867*a*), Rebel (1907), Brèthes (1920), and Biezanko *et alii* (1957) are considered likely to refer to *murariella* but substantive specimens have not been examined. The illustrations of the aedeagus of this species by Petersen (1959*a*) and Căpuşe (1968) show the surface of the cornuti as distinctly abrasive, with closely-packed small, thorn-like projections covering the ends. I have not observed cornuti of this type: in the 18 preparations I have examined the cornuti have serrations restricted to the region of the oblique edge of the cornutus and the side of the cornutus may have one or two spine-like projections.

The records of this species from Venice (Petersen, 1961*c* : 531) and the Yemen (Petersen, 1961*a*) are erroneous and are referable to *messalina* (q.v.).

BIOLOGY. This species appears able to utilize much the same range of foodstuffs as *pellionella* and *translucens*; it is a synanthrope and a pest. I have examined specimens of *murariella* reared from fur, woollen clothing, hides, hooves and insect specimens and there is a reliable literature record (Petersen, 1963*b* : 414) of its being reared from raptor pellets. Larvae (and pupae) have been collected from house walls in Spain: larvae might have been feeding on horsehair plaster. In the laboratory, *murariella* will eat wool, coarse hair, feathers, leather and fish-meal.

Tinea murariella is primarily a Mediterranean species ranging eastward as far as Sudan and northward as far as southern France and Rumania. It is present on several of the Atlantic islands and is recorded from the east coast of South America. It is likely that it is an introduction to the Neotropical region.

This species was first reared in the laboratory by Chauvin (1977). His stock originated in Brazil and was intercepted on hides imported into France: a subculture of Chauvin's stock is now maintained in BMNH. Chauvin found that, under laboratory conditions, *murariella* produced four generations per year but outdoors in western France the culture was univoltine and only survived the winter in mild years. The life-cycle and the duration of its stages is similar to that observed in *pellionella* and *translucens* under similar conditions. Chauvin (1977) found that for *pellionella*, the optimal humidity for larval development was 50% with mortality increasing with deviation from 50%. In *murariella*, a humidity of 50–100% was optimal and very high mortality occurred at low humidities, there being no survival at all at 10% R.H. or less. Chauvin gives a detailed study of water conservation in this species and compares its adaptations and survival in dry conditions with those of *pellionella*. My observations of *murariella* emphasize its similarity in behaviour and appearance in culture to *translucens*.

Wolff (*pers. comm.*), while collecting in Madeira, found a pupa of *murariella* buried in loose soil some way from human habitation. It is conceivable that this specimen originated from a bird pellet.

This species may be a commoner and more frequently carried pest than is presently realized. Chauvin's cultures came from a cargo of Brazilian hides and the only specimen recorded from Britain was intercepted in a cargo of hooves. Like *translucens*, *murariella* is fecund and successful at the normal temperatures of centrally heated premises in temperate regions.

Rearing of *murariella* in the laboratory is accomplished in exactly the same way as described above for *translucens*.

Parasite. Braconidae: *Apanteles riograndensis* Brèthes – S. America (Brèthes, 1920 – on '*pellionella*').

Distribution. (Fig. 79.) Great Britain (one interception only), France, Portugal, Spain, Canary Islands, Madeira, Azores, Morocco, Algeria, Egypt, Venezuela, Argentina, Brazil. The following additional locality records from the literature are here accepted as reliable: Rumania (Căpuşe, 1968), U.S.S.R. (Adzhar) (Kudrjavtseva, 1975), Sudan (Petersen, 1963*b*).

Material examined

Great Britain: 1 ♀ (genitalia slide only), Strathclyde region, Glasgow, Princes Dock, SS *Empire Newton*, ex hooves from Argentina, i.1946 (*Salmond*). **France**: 1 ♀, Hyères, in hotel, 26.xi.1932 (*Fletcher*); 1 ♀, St Jean de Luz, 28.viii.1951 (*Adkin*); 1 ♀, 'S. France', 1884 (*Ragonot*); 134 ex., Marseilles, ex hides originating from S. Brazil [Rio de Janeiro or São Paulo] (*Chauvin*) BMNH culture (4 ex. in NMNH, Washington). **Portugal**: 1 ♂, Porto, Marco (*Wattison*). **Spain**: 2 ex., 4 cases, 1 larva, Granada, on walls of house, 28.v, 19.vii.1901 (*Walsingham*); 1 ♂, [Cadiz, Chiclana, bred from chalk and dust cases on house walls, v.] (*Staudinger*) (genitalia slide [Agenjo]; MNHU, Berlin) (paralectotype of *murariella*). **Canary Islands**: 1 ♀, Tenerife, Guimar, ex larva on walls, 2.vi.1907 (*Walsingham*); 2 ♂, Tenerife, Sta Cruz, 22, 25.i.1907 (*Walsingham*); 1 ♂, Tenerife, Pto Orotava, 3.v.1907 (*Walsingham*); 1 ♂, Tenerife, Playa de las Américas, 17.viii.1977 (*Tuck*). **Madeira**: 1 ♀, ex Bethune-Baker coll.; 1 ♂, Deserta Grande, ex case in soil, 22.iv.1974 (*Wolff*) (coll. Wolff, Copenhagen). **Azores**: 1 ♂, Flores, Sta Cruz, 16–30.vi (*Storå*) (ZMU, Helsinki). **Morocco**: 7 ex., Tangiers, 4, 18.xii.1901, 5.iv, 1, 9, 20.v.1902, 27.v.1930 (*Walsingham*, *Fletcher*). **Algeria**: 4 ex., Prov. Oran, Sidi-bel-Abbès, 18, 22.vi, 2.ix.1917 (*Rotran*). **Egypt**: 1 ♀, Aswan, 1920 (*Hayward*); 1 ♀, ex larva damaging overcoats in Police stores, 9.iv.1918 (*Alfieri*) (NMNH, Washington). **Venezuela**: 1 ♀, Caracas, El Valle, reared from fur, 14.viii.1941 (*Ballou*) (NMNH, Washington). **Argentina**: 1 ♀, Buenos Aires (*Areco*)/Montevideo Parasit. Lab., museum pest, 20.viii.1942 (*Silveira*) (NMNH, Washington); see also Great Britain. **Brazil**: see France.

Tinea lanella Pierce & Metcalfe

(Figs 1, 2, 12, 25, 35, 36, 49, 53, 64, 92, 93)

Tinea lanella Pierce & Metcalfe, 1934, *Entomologist* **67**: 267. LECTOTYPE ♂ (abdomen and genitalia only), [Great Britain: Merseyside, Liverpool, wool warehouse, vi–vii.1922 (*Mansbridge*)] (genitalia slide no. Pierce 3204; BMNH), here designated [examined].

Tinea lanella Pierce & Metcalfe; Pierce & Metcalfe, 1935: 95, pl. 58 [♂, ♀ genitalia]; Ford, 1949: 184 [biology]; Agenjo, 1952: 61 [erroneously placed as a synonym of *pellionella*]; Petersen, 1957: 146, figs 112, 113 [genitalia]; Zagulajev, 1960: 164 [description]; Petersen, 1960: 227, fig. 7 [♂ genitalia; Spain]; Petersen, 1964*d*: 417 [Spain]; Căpuşe, 1968: 335, figs 176A–C [Rumania; ♂, ♀ genitalia]; Bradley *et alii*, 1972: 8 [checklist].

♂ (Fig. 92). 11–15 mm. Head ochreous cream. Maxillary palpus whitish, reaching tip of second segment of labial palpus. Labial palpus pale ochre, whitish on inner surface, outer surface flecked with brown. Galea reaching to between base and one-quarter length of second segment of labial palpus. Antenna light brownish ochre, three-quarters or more length of fore wing. Thorax and tegula light ochre, suffused anteriorly with blackish brown. Fore wing light ochre, fringes concolorous, base of costa suffused blackish brown. Discocellular spot light greyish brown, small; discal and plical spots yellowish brown, small, ill-defined. Hind wing greyish with slight ochreous tint at margin, fringes paler. Legs light ochreous, fore legs dusted above with dull brown.

♀ (Fig. 93). 14–17 mm. Coloration as ♂.

GENITALIA ♂. Saccus 0·87 ± 0·23 mm long. Valva (Fig. 49) with costa markedly concave to about two-thirds, apex truncated. Dorsal margin of gnathos straight in middle, markedly concave at base and tip. Anellus spines (Figs 35, 36) very small, arranged in a patch of only 12–14 widely separated spines. Aedeagus (Fig. 25) 1·32 ± 0·07 mm long, two large serrate comb-shaped carinae at or just below tip; vesica ornamented with two elongate, evenly tapered cornuti. Aedeagus/saccus ratio 1·55 ± 0·45.

GENITALIA ♀. Eighth sternite with shallow, square emargination with anterior nick, ventral lip of ostium heavily sclerotized on internal surface (Fig. 64). Antrum small, slightly bulbous, transverse folds of posterior internal wall absent, longitudinal folds ill-defined, not transversely divided. Wall of ductus bursae with sclerotization just anterior to end of antrum, forming an even band, not annular stripes. Posterior third of ductus bursae finely scobinate. Corpus bursae (Fig. 53) with one or two very small, short, needle-like signa set off-centre in a small, pimple-like sclerotized base.

REMARKS. *Tinea lanella* differs, in the male, from other members of the *pellionella*-group in possessing a pair of large, comb-shaped carinae just below the tip of the aedeagus. The two large cornuti are somewhat similar to those of *messalina* or *murariella* but these two species have no carinae. Females differ from other members of the *pellionella*-group (with the exception of *bothniella*) in having the posterior region of the ductus bursae finely scobinate. In *bothniella* the membrane of the ductus bursae is coarsely scobinate and in all other members of the *pellionella*-group it is smooth. The signa of *lanella* are smaller than those of any other species with two signa: no other *pellionella*-group species is known which may have only one signum. The shape and sclerotization of the eighth sternite and antrum of *lanella* are distinctive.

Pierce & Metcalfe (1934) differentiated this species on the basis of its having only one signum: their observations are based on Pierce's two slides (nos 3203, 3204) of *lanella*. A subsequent preparation (slide no. 1327; BMNH) clearly shows two signa of the same kind as in Pierce's preparations.

Apart from the type-series of this species, only three other specimens are known, two males from Burgos, Spain (Petersen, 1960) and a male from Bucharest, Rumania (Căpuşe, 1968).

In the figure of the genitalia of a male *lanella* from Spain by Petersen (1960 : fig. 7), the comb-shaped carinae appear to be retracted into the aedeagus. The three males from the type-series which have been dissected all have a spermatophore partly extruded from the tip of the aedeagus, the vesica is partly everted and the cornuti protrude from the aedeagus. The male illustrated by Căpuşe (1968 : fig. 176A) shows similar extrusion of a spermatophore and so Petersen's specimen is the only one known in which the genitalia are in a normal state. In specimens examined, however, the comb-shaped carinae are set in the heavily sclerotized wall of the aedeagus and could not be retracted into the aedeagus. The orientation of the carinae in Petersen's figure leads me to believe they are on the outside of the aedeagus but may be within the anellus in his preparation.

BIOLOGY. The type-series of *lanella* was from a wool warehouse in Liverpool and contains specimens bred from wool although Pierce & Metcalfe (1934) are not specific on this point. The rarity of *lanella* makes pointless any guess at the natural biotope of this species. Adults have been collected in June and July.

The presence of *lanella* in a wool warehouse suggests that it may have been imported with raw wool but the source of the Liverpool specimens is unknown.

DISTRIBUTION. Great Britain. The following additional locality records from the literature are here accepted as reliable: Spain (Petersen, 1960), Rumania (Căpuşe, 1968).

MATERIAL EXAMINED

17 ex. (3 ♂, 3 ♀ genitalia preparations).

Great Britain: 1 ♀ (abdomen and genitalia only) [Merseyside, Liverpool, wool warehouse, vi–vii.1922] (*Mansbridge*) (genitalia slide no. Pierce 3204); 1 ♂, 1 ♀ (abdomen and genitalia only) [Merseyside, Liverpool, wool warehouse, vi–vii.1922] (*Tyerman*) (genitalia slide no. Pierce 3203); 1 ♂, Merseyside, Liverpool (*Pierce*) (abdomen missing); 7 ♂, 9 ♀, Merseyside, Liverpool, bred [from wool warehouse], vi–vii.1922 (*Tyerman*) (all paralectotypes of *lanella*).

Tinea messalina sp. n.

(Figs 1, 24, 34, 48, 54, 63, 94, 95)

[*Tinea murariella* Staudinger; Petersen, 1961*a* : 65; Petersen, 1961*c* : 531. Misidentification.]

♂ (Fig. 94). 12 mm. Head light ochre. Maxillary palpus whitish. Labial palpus whitish, densely flecked with dark brown on outer surface. Galea not visible – head preparation not made owing to lack of material. Antenna greyish brown, extending to tip of fore wing. Thorax and tegula light ochreous flecked with brown, dark brown anteriorly. Fore wing light ochreous speckled with brown scales which are especially dense in basal fascia; fringes light ochreous. Discal and plical spots not defined, discocellular spot small, greyish brown. Hind wing whitish with a slight grey tint, base of fringes tinted ochreous. Legs light ochre to whitish, fore leg and mid tibia dull brown above.

♀ (Fig. 95). 15–16 mm. Coloration as ♂ but specimen from Tenerife has darker, more greyish fore wings and fore wing markings and more greyish hind wing. Discal and plical spots defined in two specimens but not visible in specimen from Algeria which is badly rubbed. Galea (visible only in Tenerife specimen) very short.

GENITALIA ♂. Saccus 0·98 mm long. Valva (Fig. 48) large, slender, with rounded apex. Dorsal margin of gnathos with slight medial convexity, angled dorsad at one-third and just below apex. Anellus spines (Fig. 34) large, arranged in elongate band three to four spines wide with proximal ten of about twenty well-defined spines heavily sclerotized. Aedeagus (Fig. 24) elongate, 1·86 mm long, without carinae. Vesica with two elongate, blade-shaped cornuti which are coarsely serrate below apex and which have minute thorn-like projections on lateral surfaces. At three-quarters length of aedeagus, vesica armed with three small, slender cornuti (Fig. 24 – inset). Aedeagus/saccus ratio 1·90.

GENITALIA ♀. Eighth sternite with shallow U- (Tenerife specimen) or V-shaped emargination with wall of ostium heavily sclerotized at base of emargination (Fig. 63). Posterior region of antrum swollen only slightly, transverse folds ill-defined. Longitudinal folds narrow, ill-defined, not transversely divided. Anterior region of antrum broad, parallel-sided. Wall of ductus bursae with well-defined annular sclerotization slightly anterior to end of antrum, appearing as dark stripes. Corpus bursae with three conspicuous needle-shaped signa (Fig. 54), each arising from one side of a short, blade-shaped base set in a large, circular, heavily sclerotized base-plate. In specimen from Yemen, sclerotization of signum base-plate uneven, giving it etched appearance and irregular margin.

REMARKS. *Tinea messalina* resembles *Tinea murariella* in its external appearance and cannot be reliably separated from it except by examination of the genitalia. In the male, the two large cornuti are similar to but larger than those of *murariella* which lacks the three small cornuti present in *messalina*. The small, thorn-like protuberances from the large cornuti are similar to those figured for *murariella* by Petersen (1959*a*) and Căpuşe (1968) (see 'Remarks' for *murariella*). In the female, the antrum is larger and broader than in *murariella*. The uneven edges of the signum base-plates in the Yemeni specimen are reminiscent of those of *translucens* but are much more pronounced. The corpus bursae is missing from the specimen from Tenerife: this, coupled with the dissimilarly shaped antrum, leads me to exclude it from the paratype series. All the specimens here placed as *messalina* have previously been examined by Petersen who determined them as *murariella*. In Petersen's preparations of the two female paratypes, the genitalia have not been removed from the abdomen and it is impossible to discern the outline of the corpus bursae (Fig. 54).

BIOLOGY. Unknown. Specimens examined originate from the wetter parts of the Mediterranean region and from highland Yemen which has forested zones near San'a (the locality of collection of the specimen). Specimens were collected in January ('domestic' environment, Yemen) or May (all other specimens).

DISTRIBUTION. Canary Islands (Tenerife), Algeria, Italy, Yemen.

MATERIAL EXAMINED

4 ex. (1 ♂, 3 ♀ genitalia preparations).

Holotype ♂, **Italy**: Venice, Lido I., 29.v.1910 (*Walsingham*) (genitalia slide no. 8214 [Petersen prep. no. 1408]; BMNH).

Paratypes. **Algeria**: 1 ♀, Hammam-mes-Kontine, 2.v.1914 (*Rothschild & Jordan*) (genitalia slide no. 11076 [Petersen prep. no. 1719]; BMNH). **Yemen**: 1 ♀, San'a, within walls of Bir-el-Azab, caught in pavilion of the Crown Prince while we were waiting for an interview, 2400 m, i.1938 (*Scott & Britton*) (genitalia slide no. 7215 [Petersen prep. no. 1508]; BMNH).

Specimen excluded from paratype series. **Canary Islands**: 1 ♀, Tenerife, Pto Orotava, 2.v.1907 (*Walsingham*) (genitalia slide no. 11080 [remount of Petersen prep. no. 1561]; BMNH).

Tinea dubiella Stainton

(Figs 1, 2, 17, 41, 42, 47, 55, 62, 80, 96–99)

Tinea dubiella Stainton, 1859, *Entomologist's wkly Intell.* **6**: 183. LECTOTYPE ♀, GREAT BRITAIN: Merseyside, Liverpool, 18.viii.1859 (*Gregson*) (genitalia slide no. 13389; BMNH), here designated [examined].

Tinea turicensis Müller-Rutz, 1920, *Mitt. Ent. Zürich* **5**: 348, pl. 2, fig. 16. Lectotype ♂ (genitalia only), SWITZERLAND: Zürich (*Nägeli*) (genitalia slide no. M.28; NM, Basle), designated by Rasmussen, 1964: fig. 21 [examined]. **Syn. n.**

Tinea bispinella Zagulajev, 1960, *Fauna SSSR* **78**: 169, figs 132–134. Holotype ♂, U.S.S.R.: Crimea, Sevastopol, 22.vi.1907 (*Pliginski*) (ZI, Leningrad) [examined]. **Syn. n.**

Tinea tenerifi Zagulajev, 1966, *Trudy̆ zool. Inst. Leningr.* **37**: 169, figs 22, 23. Holotype ♂, CANARY ISLANDS: Tenerife, Orotava, 24.iv.1895 (GAM, Bucharest) [examined]. **Syn. n.**

Tinea dubiella Stainton; Stainton, 1859*c*: 133; Wocke, 1861: 107 [catalogue]; Morris, 1870: 22, pl. 99, fig. 8 [description; figure; in birds' nests]; Wocke, 1871: 270 [catalogue]; Stainton, 1874: 3 [erroneously placed as a synonym of *pellionella*]; Merrin, 1875: 242 [synonym (?) of *pellionella*]; Hartmann, 1879: 199 [list]; Meyrick, 1895: 791 [synonym of *pellionella*]; Dyar, [1903]: 572 [synonym of *pellionella*]; Crombrugghe de Picquendaele, 1906: 124 [synonym of *pellionella*]; Corbet & Tams, 1943*b*: 111 [synonym of *pellionella*]; Petersen, 1957: 145 [synonym of *pellionella*]; Zagulajev, 1960: 149, 159 [synonym of both *pellionella* and *flavescentella*]; Căpuşe, 1968: 319 [synonym of *pellionella*]; Petersen, 1969: 373 [synonym of *pellionella*]; Bradley *et alii*, 1972: 8 [synonym of *pellionella*].

Tinea turicensis Müller-Rutz; Müller-Rutz, 1922: 256 [Switzerland]; Müller-Rutz, 1932: 263 [erroneously placed as synonym of *pellionella*]; Petersen, 1957: 148, fig. 114 [♂ genitalia]; Petersen, 1960: 228 [Spain; ♀ genitalia]; Petersen, 1961*c*: 532 [Algeria; Morocco]; Wakely, 1962: 92 [Britain; breeding record]; Petersen 1963*b*: 414 [birds' nests; owl pellets]; Petersen, 1964*b*: 79 [status as 'household species']; Petersen, 1964*d*: 404, 417 [Spain]; Rasmussen, 1964: 337, pls 5–8, figs 17–29 [♂, ♀ genitalia; lectotype designated]; Gozmány & Szőcs, 1965: 143, figs 36B, 37B [key; genitalia figs]; Bradley, 1966*a*: 217 [synonymy amended]; Petersen, 1968: 98 [Germany]; Căpuşe, 1968: 328, fig. 171 (*partim* – ♂ only) [♂ genitalia; Rumania]; Petersen 1969: 374, pl. fig. 25, figs 152, 161, 169 [♂, ♀ genitalia; biology; distribution]; Krogerus *et alii*, 1971: 28 [Sweden; Denmark]; Bradley *et alii*, 1972: 8 [checklist]; Petersen & Gaedike, 1975: 76 [Germany]; Kudrjavtseva, 1975: 619, figs 1, 2 [U.S.S.R. (Adzhar); ♂, ♀ genitalia; biology]; Hannemann, 1977: 222, pl. 14, fig. 5, figs 121a–b [genitalia; distribution].

Tinea bispinella Zagulajev; Kudrjavtseva, 1975: 622 [U.S.S.R.—Georgia].

[*Tinea pellionella* L.; Stainton, 1859*d*: 212 [Madeira]; Wollaston, 1879: 422 [St Helena]; Meyrick, 1893: 535 [Australia]; Rebel & Rogenhofer, 1894: 17, 88 [Canary Is]; Rebel, 1906: 44 [Canary Is]; Rebel, 1910: 366 [Madeira]; Rebel, 1917: 13, 25, 62 [Madeira, Canary Is, St Helena]. Misidentifications.]

[*Tinea metonella* Pierce & Metcalfe; Pierce & Metcalfe, 1934: 266 (*partim* – 1 ♂ only); Petersen, 1957: 148 and Rasmussen, 1964: 337 [*metonella* (based on Pierce slide 3208 – i.e. *dubiella*) erroneously placed as synonym of *turicensis*]. Misidentifications.]

[*Tinea flavescentella* Haworth; Bradley, 1953: 18 (*partim* – 1 ♂ only) [Ireland]; Căpuşe, 1968: 331, figs 172B, 173B–C (*partim* – ♀ only) [♀ genitalia; Rumania]. Misidentification.]

♂ (Fig. 96). 9–12 mm. Head greyish ochre. Maxillary palpus light grey, reaching just beyond tip of second segment of labial palpus. Labial palpus dark grey, light grey on inner surface, tip paler. Galea extending to middle of second segment of labial palpus. Antenna dark brownish grey, reaching apex of fore wing. Thorax and tegula dull brownish grey, darker anteriorly. Fore wing dull brownish grey with a few scattered yellowish scales, fringes concolorous; charcoal-grey scales at base of costa and in fold. Discal and plical spots charcoal-grey, elongate; discocellular spot darker, round. Hind wing grey, fringes brownish. Legs greyish ochre, fore leg and mid tibia blackish brown above.

♀ (Fig. 97). 11–15 mm. Coloration as ♂.

GENITALIA ♂. Saccus 0·78 ± 0·17 mm. Valva (Fig. 47) with costa slightly convex, apex rounded but more or less truncated at costal margin. Dorsal margin of gnathos evenly concave or almost straight in the middle; tip upturned towards uncus. Anellus spines (Figs 41, 42) flattened and overlapping, arranged in a tapered band up to four spines wide and containing about 20 spines; proximal spines large. Aedeagus (Fig. 17) 1·30 ± 0·26 mm long, without carinae. Vesica ornamented only with pair of small, short, divergent, peg-shaped cornuti just below apex of aedeagus. Aedeagus/saccus ratio 1·69 ± 0·29.

GENITALIA ♀. Eighth sternite with broad, shallow V-shaped emargination (Fig. 62). Antrum markedly swollen posteriorly; transverse folds present and anterior to these a pair of conspicuous saucer-shaped lateral protuberances; anterior region of antrum short, slightly tapered anteriorly, longitudinal folds short, conspicuous, not transversely divided. Annular sclerotization at posterior end of ductus bursae ill-defined or absent. Corpus bursae (Fig. 55) with three or (usually) four small, thin, needle-like signa, each arising from minute unsclerotized tubercle.

REMARKS. *Tinea dubiella* is generally darker-coloured than any of the other species of the *pellionella*-group. Fresh and undamaged specimens in particular have darker and more greyish fore wings than other members of the *pellionella*-group and the hind wing is distinctly darker, being grey rather than ochreous-whitish or very pale grey as in the other species. In the male, the greatly reduced pair of peg-like cornuti (probably homologous with the large blade-shaped cornuti of other members of the *pellionella*-group) are characteristic: there are no carinae of any kind on the aedeagus. The female genitalia are remarkable for the curious development of the paired saucer-shaped protuberances of the postero-ventral wall of the antrum.

Four specimens of *dubiella* are known in which the coloration is aberrant. A specimen bred from a larva collected in Lincolnshire in 1976 is melanic (Fig. 99) and three female paralectotypes of *dubiella* are pale, bright yellow with much reduced fore wing markings (see Stainton, 1859*a*) (Fig. 98). The remaining three paralectotypes and lectotype of *dubiella* have normal coloration: both sexes are represented among the normal specimens of Stainton's series, not just males as he suggested (1859*a*).

This is the *Tinea turicensis* of authors following Petersen (1957) and has nothing to do with *Tinea metonella* Pierce & Metcalfe (see 'Remarks' for *translucens* – above). Before Petersen's examination of Müller-Rutz's specimens, *turicensis* had been ignored as Müller-Rutz himself (1932) came to consider it as 'only a form of *pellionella*' in exactly the same way as Stainton (1874) came to think that *dubiella* was 'only *pellionella*'. It is odd that the syntype-series of *dubiella* has not, until now, been closely examined. One specimen was dissected by Corbet in about 1941 (the slide is now apparently lost) but *dubiella* was considered by Corbet & Tams (1943*b*) to be a synonym of *pellionella*.

The Müller-Rutz collection (in NM, Basle) contains four moths (one with associated genitalia slide) and three slides of male genitalia (without associated moths) labelled as *turicensis*. Two of the moths, a male (without abdomen) and a female (genitalia slide no. 1745 [Petersen]/M.27), are type-specimens; the other two specimens, both undissected males, have no type-status. Two slides (M.28 and M.29) are labelled 'TYPUS'; M.29 may be from the above male type-specimen – there is a complete abdomen preserved on the slide and the whole of the abdomen has been removed from the specimen whereas in slides M.28 and M.30 only the seventh and eighth abdominal segments are preserved. The slides numbered M.28 and M.30 are not associated with specimens and M.30 has no type-status. Slide M.28 is the lectotype, designated by Rasmussen (1964), and I have labelled it as such. I have labelled the male and female type-specimens and slide M.29 as paralectotypes.

Several authors have misidentified specimens of *dubiella* as *pellionella* (see above), notably from Madeira, St Helena and the Canary Islands, localities from which *pellionella* is unknown. Căpuşe (1968) illustrated the female genitalia of this species as *flavescentella*.

It is surprising that *dubiella* has been overlooked for so long. About half the '*pellionella*' in British collections examined have been found to be referable to *dubiella* and Rasmussen (1964) found the same proportion of misidentified specimens in Denmark. In F. N. Pierce's slide collection, four females of *dubiella* are segregated on slide no. 3223. Pierce's slide no. 3219 is of a male *dubiella* and is labelled '*? T. pellionella*'; his only other male is a syntype of *metonella*. His female *dubiella* (slide 3223) are labelled '*pellionella*' but he also had four other slides of genuine *pellionella*. It is evident that although Pierce recognized *dubiella* as different from *pellionella*, he did not pursue the investigation of its identity.

BIOLOGY. It is likely that *dubiella* is able to utilize much the same kinds of foodstuffs as *pellionella*. I have bred *dubiella* from damp carpet lining a disused dog-kennel; the carpet was also heavily infested with *Hofmannophila pseudospretella* (Stainton) (Oecophoridae). Petersen (1963*b*) has recorded *dubiella* (as *turicensis*) from swallows' nests and from pellets of barn owl. Wakely (1962) bred *dubiella* from an 'animal-skin rug' and found that the larvae also ate feathers. Specimens from T. B. Fletcher's collection (BMNH) are from stables or bred from birds' nests and specimens were bred from chicken feathers by Back (see 'Material examined'). Many of the specimens examined are labelled as having been collected in houses. I have found an adult and a pupa of *dubiella* on the walls of a bunk-room containing old feather pillows and horsehair mattresses. Two of Walsingham's specimens from Tenerife were collected as larvae or pupae on walls, a biotope reminiscent of that of *murariella* in Spain where the larvae probably feed on horsehair in plaster. Another of Walsingham's specimens is labelled 'ex marsh plant' but this must have been a pupation site.

The distribution of *dubiella* is remarkably wide, extending from Scandinavia south to St Helena and South Africa and eastward to Australia and New Zealand. Its distribution outside temperate western Europe and the Mediterranean region is sporadic, however, and *dubiella* must be considered as an introduction to Australasia and also to North America from where only four specimens are known. In Britain, *dubiella* has not been collected outdoors further north than Lincolnshire although little collecting of Tineidae has been done in the north of England or Scotland.

Little is known of the life-cycle of *dubiella*. Of 60 specimens examined from Britain, France and Germany, 31 were collected in July and the dates of collection range from May to September. Kudrjavtseva (1975) records adults of *dubiella* in the Caucasus from May to August. Of 18 specimens from the Canary Islands, Madeira, Spain, Morocco, Algeria and Sikkim, seven were collected in April, eight in May and single specimens in March, June and November. The November record (from Algeria) suggests that *dubiella* may be bivoltine in warmer latitudes where adults of the first generation fly about ten weeks earlier than in Britain. I have seen eight specimens from Australia and New Zealand, three collected in October, four in November, one in December and one in April, the last also possibly indicative of a second annual generation.

Wakely (1962) had, apparently, little difficulty in rearing *dubiella* but almost full-grown larvae, which I collected in Lincolnshire in July, proved difficult to rear. Placed on wool and fishmeal and kept at 20 °C, the larvae would not feed until the substrate was dampened (when the fish-meal began to decompose). The larvae moulted four times and only one adult was eventually reared, a melanic specimen (Fig. 99), which emerged in February the following year.

It is likely that *dubiella* has been extensively transported by man but the only definite record appears to be that of a female intercepted at Glasgow, in 1946 in a cargo of wool imported from New Zealand.

DISTRIBUTION. (Fig. 80.) Great Britain, Ireland, France, Germany, Switzerland, Spain, Madeira, Canary Islands, Morocco, Algeria, Sikkim, St Helena, South Africa, Australia, New Zealand, U.S.A. The following additional locality records from the literature are here accepted as reliable: Denmark (Rasmussen, 1964), Sweden (Krogerus *et alii*, 1971), Rumania (Căpuşe, 1968), U.S.S.R. (Georgia, Adzhar) (Kudrjavtseva, 1975).

MATERIAL EXAMINED

106 ex. (40 ♂, 32 ♀ genitalia preparations); 4 larvae; 10 cases; 5 pupae.

Great Britain: 3 ex., Cornwall, Redruth, 31.vii.1955, 19, 24.vi.1956 (*Tremewan*); 1 ♂, Dorset, Corfe, 15.vii.1890 (*Bankes*); 1 ♂, Dorset, Kingston, 29.vii.1887 (*Bankes*); 1 ♂, Isle of Wight, Niton, 7.vii.1930 (*Fletcher*); 3 ex., Hampshire, Southampton, 17.vii.1925, 29.vii, 9.viii.1935 (*Fassnidge*); 2 ♂, Surrey, Redhill, in house, 6.vii.1935 (*Rait-Smith*); 2 ♂, 3 ♀, Sussex, Midhurst, various dates 1961–1963 (*Wakely*); 2 ♂, Kent, Sandwich Bay, in bird observatory bunk-room, 8–10.vii.1977 (*Robinson*); 2 ex., Greater London, Bromley, 27.vi.1943 (*Jacobs*); 2 ex., Greater London, Lewisham, in house, 24.vi.1876, 30.v.1882 (*Stainton*); 1 ♀, Essex, Hadleigh, 27.viii.1915 (*Whittle*); 2 ♂, Wiltshire, Marlborough, 10.vii.1922, 1.ix.1930 (*Meyrick*, *Fletcher*); 13 ex., Gloucestershire, Stroud, Rodborough Fort [Fletcher's house], in house and from birds' nests, various dates 1933–1934 (*Fletcher*); 10 ex., Norfolk, Merton, various dates 1889–1909 (*Durrant*); 1 ♂, Lincolnshire, Woodhall Spa, bred from damp carpet in disused dog-kennel, em. ii.1977 (*H. S. & G. S. Robinson*); 2 ♂, 4 ♀, Merseyside, Liverpool, 1859 (*Gregson*) (paralectotypes of *dubiella*); 1 ♀ (genitalia slide only), Strathclyde region, Glasgow, ex wool from New Zealand on SS *Empire Strength*, 9.ii.1946 (*Ministry of Agriculture*, *Fisheries & Food*). **Ireland**: 1 ♂, Co. Cork, Bantry, 4–15.vi.1952 (*Bradley*). **France**: 3 ex., Basses Pyrénées, St Pierre d'Irube, 25.vi.1936, 21, 27.v.1937 (*Adkin*); 1 ♀, Basses Pyrénées, St Jean de Luz, 13.vi.1950 (*Adkin*); 1 ♂, Cabrerets, 3–10.vii.1949 (*Jacobs*); 1 ♂, Cote d'Azur, St Aygulph, ex marsh plant [sic], 8.vii.1901 (*Walsingham*). **Germany (West)**: 2 ♂, 5 ♀ (of 3 ♀, genitalia slides only), Schleswig-Holstein, Flensburg, various dates 1957–1958 (*Sattler*); 1 ♂, 1 ♀, Dortmund, 11, 13.vii.1933 (*Grabe*). **Switzerland**: 1 ♂, 1 ♀, Zürich, 28.vi, 11.vii.1918 (genitalia slide nos M.29 [Müller-Rutz], Pet. 1745 [Petersen]; NM, Basle) (paralectotypes of *turicensis*); 1 ♂ (genitalia slide only), Zürich (genitalia slide no. M.30 [Müller-Rutz]; NM, Basle) (no type status); 2 ♂, Zürich, ex larva, 2, 10.vi.1924 (*Müller-Rutz*) (NM, Basle) (no type status). **Spain**: 1 ♂, Granada, 14.vi.1901 (*Walsingham*). **Madeira**: 2 ♂, 1858 (*Wollaston*) (one ex Bethune-Baker coll.); 1 ♂, Machico, 23.iv.1904 (*Eaton*). **Canary Islands**: 1 ♂, 1 ♀, Tenerife, Guimar, on walls 27.iv, emerged 6.v.1907 (*Walsingham*); 1 ♂, Tenerife, Las Mercedes, 29.v.1907 (*Walsingham*); 1 ♂, Tenerife, iv.1885 (*Leech*). **Morocco**: 2 ex., Zig, 9.iv.1902 (*Walsingham*); 4 ex., Tangier, 14.iv, 4, 9.v.1902 (*Walsingham*); 1 ♂, Tangier, iii.1868 (*Blackmore*). **Algeria**: 2 ex., El Kantara, 22, 23.v.1903 (*Walsingham*); 1 ♂, Bône, 8.xi.1893 (*Eaton*). **Sikkim**: 1 ♂, 1 ♀, Kurseong, 1525 m, 26.iv.1922 (*Fletcher*). **St Helena**: 1 ♂ (*Wollaston*). **South Africa**: 1 ♀, Natal, Weenen, Estcourt, Kimbolton, 1892 (*Hutchinson*). **Australia**: 1 ♀, Parramatta, iv.1879 (*Raynor*); 1 ♀, Sydney, 3.xi.1884 (*Meyrick*); 1 ♀, Toowong, 27.x.1898 (*Dodd*); 2 ex., Melbourne, xi.1888 (*Anderson*); 1 ♀, Port Lincoln, 5.xi.1882 (*Meyrick*); 1 ♂, Carnarvon, 22.x.1886 (*Meyrick*). **New Zealand**: 1 ♀, Nelson, 27.xii.1925 (*Philpott*) (MARC, Auckland). **U.S.A.**: 1 ♀, California, Los Angeles, Venice, viii.1918 (*P.*); 3 ♂, 1 ♀, Washington, D.C., ex feathers in chicken house, 26.v.1925 (*Back*) (NMNH, Washington). **No Data**: 8 genitalia preparations by F. N. Pierce and A. S. Corbet.

Tinea steueri **Petersen**

(Figs 66, 69, 71, 72, 100)

Tinea steueri Petersen, 1966, *Ent. Nachr. Dresden* **10**: 35, figs 2, 3. Holotype ♂, GERMANY (EAST): Thuringia, Bad Blankenburg, 20.vi.1965 (*Steuer*) (genitalia slide no. Pet. 2269 [Petersen]; coll. H. Steuer, Bad Blankenburg) [genitalia slide examined].

Tinea steueri Petersen; Petersen, 1969 : 375, figs 156, 165 [redescription]; Petersen & Gaedike, 1975 : 76, fig. 1 [♀ genitalia]; Hannemann, 1977 : 220, pl. 17, fig. 6, figs 120a–b [♂, ♀ genitalia].

♂. 12 mm. Only genitalia slide examined. From Petersen's description, similarly patterned to ♀.

♀ (Fig. 100). 17 mm. Head ochreous with slight reddish tint. Maxillary palpus whitish, apparently long, extending well beyond tip of second segment of labial palpus [head preparation not made owing to lack of material]. Labial palpus greyish ochre, blackish brown on outer surface. Antenna dull grey-brown, almost reaching apex of fore wing. Thorax and tegula dull grey-brown, darker anteriorly. Fore wing light greyish brown, flecked with dark grey-brown scales, base of costa and plical fold darker than remainder of wing; fringes light greyish brown. Discal and plical spots ill-defined, discocellular spot small, greyish brown. Basal quarter of costa swollen, with small, elongate, hyaline spot between *Sc* and R_1. Hyaline spot lacks scales on underside of wing and is covered above with thin, colourless scales. Hind wing very light grey, fringes paler. Legs light ochre, fore leg dark brown above.

GENITALIA ♂. Saccus short, 0·59 mm long. Valva (Fig. 71) triangular with apex evenly rounded, sacculus heavily sclerotized. Dorsal margin of gnathos slightly concave, tip not upturned; tip of uncus extended posteriorly and bent towards tip of gnathos. Anellus spines (Fig. 69) very large, arranged in elongate band of 11 spines edged with sclerotized plaques and with a few small thorn-like spines at distal end of band. Aedeagus 1·1 mm long [but this may be an underestimate – tip is broken], very broad, apparently without cornuti or carinae. Aedeagus/saccus ratio [possibly low – aedeagus damaged] 1·86.

GENITALIA ♀. Eighth sternite with deep, wedge-shaped emargination almost completely dividing sternite (Fig. 66). Antrum very broad, flattened and curved parallel with surface of eighth sternite; transverse folds ill-defined. Anterior region of antrum represented only by short neck without longitudinal folds. Corpus bursae (Fig. 72) with four or five short, needle-like signa, each set in pyramidal base, posterior two signa set in very small sclerotized base-plates.

REMARKS. *Tinea steueri* is a large, dark species with a superficial resemblance to *pellionella* but it differs externally from all other members of the *pellionella*-group in having a narrow hyaline spot at the base of the fore wing costa. This zone is sometimes thinly scaled in the other species described here and, additionally, may be rubbed but in *steueri* the modification is conspicuous and the costa is convex around the spot. The greatly expanded antrum of the *steueri* female is characteristic. In the male, the anellus spines are very similar to those of *bothniella* and much larger than in the other members of the *pellionella*-group. The holotype of *steueri* is the only male known and in Petersen's dissection of the genitalia, the tip of the aedeagus has been broken off and pulled away with part of the vesica. The male genitalia of *steueri* are remarkably similar in practically all respects to those of *bothniella* but there is no trace of a cornutus in the remnants of the vesica of the holotype of *steueri*. The similarities include the peculiar form of the uncus and gnathos, the width of the aedeagus, the length of the saccus and the remarkable form of the anellus spines. The valva of *steueri* is, however, different from that of *bothniella*, being shorter and more triangular. The external appearance of the two species is quite different as is the structure of the female genitalia. There are similarities, too, between the male genitalia of *steueri* and *dubiella* but in the latter species the anellus spines are smaller and the tip of the uncus is not as strongly downturned towards the tip of the gnathos.

Petersen's (1966; 1969) and Hannemann's (1977) illustrations of the male genitalia of this species are inaccurate and figure the anellus spines as being part of the vesical ornamentation: their illustrations do not suggest that the aedeagus is damaged and this fact is not mentioned in their descriptions.

BIOLOGY. Unknown.

DISTRIBUTION. Germany, Hungary.

MATERIAL EXAMINED

2 ex. (1 ♂, 2 ♀ genitalia preparations), 0 larvae, 0 cases, 0 pupae.

Germany (East): 1 ♀, Thuringia, Bad Blankenburg, at light, 1.viii.1974 (*Steuer*). **Hungary**: 1 ♀, Bihar, Bischofsbad, 22.v.1913.

Tinea bothniella Svensson

(Figs 1, 67, 68, 70, 73–75, 81, 101)

Tinea bothniella Svensson, 1953, *Opusc. ent.* **18**: 225, figs 1A–1F. Holotype ♂, SWEDEN: Västerbotten, Vännäs, Hällfors, 22.vii.1950 (*Svensson*) (colln I. Svensson, Kristianstad) [examined].

Tinea unidentella Zagulajev, 1960, *Fauna SSSR* **78**: 168, figs 130, 131. 2 ♂ syntypes, U.S.S.R.: 1 ♂, nr Orsk, Guberlya, 1.vi.1891 (*Christoph*); 1 ♂, Irkutsk, Gryozhnukha, 24.vii.1934 (*Florov*). 1 ♂ syntype, MONGOLIA: Ulan Bator, 23–26.vi.1905 (*Kozlov*) (ZI, Leningrad) [examined]. [Synonymized by Petersen (1973*b*: 91).]

Tinea sibiriella Zagulajev, 1960, *Fauna SSSR* **78**: 171, figs 3G, 135. 6 ♀ syntypes, U.S.S.R.: 1 ♀, nr Orsk, Guberlya; 1 ♀, Siberia, Minussinsk, 22.vi.1924 (*Filipjev*); 1 ♀, Yeniseyskiy Prov., Bunbui, 4.vi.1915 (*Valdaev*); 3 ♀, Karagandinskaya, Zhan-Arc Station, vii.1958 (*Zagulajev*) (ZI, Leningrad) [examined]. [Synonymized by Krogerus *et alii* (1971: 28).]

Tinea bothniella Svensson; Krogerus *et alii*, 1971: 28 [checklist; *sibiriella* synonymized; Sweden]; Petersen, 1973*b*: 91 [*unidentella* and *sibiriella* synonymized; Mongolia].

Tinea unidentella Zagulajev; Petersen, 1961*c*: 532, fig. 2 [♂ genitalia; U.S.S.R. – Volgograd].

♂ (Fig. 101). 10–15 mm. Head reddish ochre. Maxillary palpus whitish, elongate, as long as or longer than labial palpus. Labial palpus light greyish ochre, whitish on inner surface. Antenna three-quarters length of fore wing, light greyish ochre, basal segments darker. Thorax and tegula light greyish ochre, not noticeably darker anteriorly. Fore wing light greyish ochre, fringes slightly paler; discal, plical and disco-cellular spots absent. Hind wing pale brownish cream, darker at margins, fringes slightly paler. Legs pale grey-brown, fore leg with only slightly darker scaling on upper surface. Abdomen light greyish ochre, paler ventrally.

♀. 14–18 mm. Coloration as ♂.

GENITALIA ♂. Saccus 0·69 ± 0·12 mm long. Valva (Fig. 70) elongate, apex rounded, not truncated, costa concave, sacculus heavily sclerotized. Dorsal margin of gnathos straight or slightly convex, tip not upturned towards uncus; tip of uncus extended posteriorly and bent towards tip of gnathos. Anellus spines (Fig. 68) very large, arranged in elongate band of 11 or 12 spines edged with and continued at distal end as sclerotized plaques. Aedeagus 1·30 ± 0·24 mm long, broad, without carinae; vesica with single large, elongate cornutus (Fig. 67) level with or protruding just beyond tip of aedeagus. Aedeagus/saccus ratio 1·88 ± 0·37.

GENITALIA ♀. Eighth sternite with deep U-shaped emargination to beyond one-half (Figs 73, 74). Posterior region of antrum swollen, parallel-sided, flattened and curved parallel with surface of eighth sternite; transverse folds absent. Anterior region of antrum extremely short, with narrow longitudinal folds which have ill-defined transverse division at one-half separating unsclerotized anterior region of fold from heavily sclerotized posterior region. Middle of antrum with heavy annular sclerotization appearing as ill-defined transverse stripes; anterior to this, inner wall of antrum finely scobinate. Corpus bursae (Fig. 75) with six elongate, needle-shaped signa, each arising from unsclerotized pimple-like base.

REMARKS. *Tinea bothniella* is a large species lacking the characteristic three spots in the fore wing of the other species of the *pellionella*-group. The male genitalia are similar to those of *steueri* (see above); the single strong cornutus is characteristic although it is uncertain whether or not a similar cornutus is found in *steueri*. The valva of this species is larger and more rectangular than in *steueri* and the base of the gnathos is angled. In the female, there are more signa than in *steueri* and these are more elongate, do not arise from a sclerotized base-plate and are not nearly as conspicuous. The posterior region of the antrum is narrower, and the eighth sternite less deeply emarginated than in *steueri* which lacks longitudinal folds in the anterior wall of the antrum. The wing pattern is quite different from that of *steueri* which has three dark spots in the fore wing and a hyaline spot at the base of the costa: *bothniella* has a uniformly greyish ochre fore wing without a hyaline spot.

The original illustrations of the genitalia of *bothniella* given by Svensson (1953) are unsuitable for critical determination but those given subsequently by Petersen (1961*c*) and Zagulajev (1960) are satisfactory. Zagulajev (1960) figures the female genitalia still within the abdomen and his description mentions only two signa. It is very difficult to see any signa in *bothniella* without removing the genitalia from the abdomen and flushing the spermatophore out of the bursa copulatrix and it is possible that Zagulajev missed several signa.

Zagulajev was able to separate specimens of *unidentella* and *sibiriella* only by their venation and by the length of the maxillary palpi. He suggested in the original description of *sibiriella* (1960 : 173) that they might be the opposite sexes of the same species. As his syntype-series of each included sympatric specimens (from Guberlya) it is surprising that he treated them as separate.

BIOLOGY. The only record of the biology of *bothniella* is given by Zagulajev (1960) who found larvae (determined as *sibiriella*) feeding in raptor pellets. It should be noted that throughout the 1975 translation of Zagulajev's (1960) work on the Tineinae, bird-pellets are erroneously translated as 'garbage' or 'refuse'. Zagulajev suggests that *bothniella* (as *sibiriella*) is confined to the steppe region, living in nests and pellets of birds, and has two or, under favourable conditions, three generations per year. His evidence for this is based on his having had adults emerge from raptor pellets in July and then in April the following year: larvae in the pellet hibernated during the winter. It is uncertain, however, whether the pellets were kept at normal Kazakhstan winter temperatures after collection or whether the April emergence was 'forced' in a temperature higher than normal.

Most of the adults of *bothniella* which I have examined were collected in July. Of seventeen specimens known to me (excluding Zagulajev's bred material), nine were collected in July, five in June and one in August: in addition, two specimens from Finland were collected in April. These April records do not support Zagulajev's contention that *bothniella* may be bivoltine; the habitat of the specimens was artificially warm – they were from a population living in the museum of Turku University (Jalava – *pers. comm.*).

The distribution of *bothniella* suggests that it is the hardiest species of the *pellionella*-group: its localities all lie to the north of the 0 °C January isotherm and in its Siberian habitats the January mean temperature is in the range −6 to −18 °C.

DISTRIBUTION. (Fig. 81.) Sweden, Finland, U.S.S.R. (Volgograd). The following additional locality records from the literature are here accepted as reliable: U.S.S.R. (European region eastward to S. Siberia) (Zagulajev, 1960 – as *unidentella* and *sibiriella*), Mongolia (Zagulajev, 1960 – as *unidentella*).

MATERIAL EXAMINED

10 ex. (4 ♂, 4 ♀ genitalia preparations), 0 larvae, 0 cases, 0 pupae.

Sweden: 1 ♀, Luleå, 14.vii.1948 (*Svensson*) (genitalia slide no. 1001 [Robinson]; UZI, Lund) (paratype of *bothniella*); 1 ♂, Degerfors, Böjern, 2.vii.1935 (*Dahlström*) (genitalia slide; UZI, Lund) (allotype of *bothniella*). **Finland**: 1 ♂, 1 ♀, Turku, 8.iv.1970 (*Linnaluoto*) (genitalia slide nos 666, 667 [Kyrki]; MZU, Oulu); 1 ♀, Sievi, 1974 (*Huhtala*) (genitalia slide no. 92 [Kyrki]; MZU, Oulu); 1 ♂, Puolanka (*Kiianlinna*) (genitalia slide no. 105 [Kyrki]; MZU, Oulu); 1 ♀, Kuusamo, 16.vii.1934 (*Löfqvist*) (ZMU, Helsinki); 2 ♀, Ruukki, 28, 30.vii.1924 (*Löfqvist*) (ZMU, Helsinki); 1 ♀, Rautalampi, 13.vii.1928 (*Klingstedt*) (ZMU, Helsinki). **U.S.S.R.**: 1 ♂, Volgograd, Krasnoarmeysk ('Sarepta'), vi.1861 or 24.vi.1864 [label refers to two specimens but there is now only one] (*Christoph*) (genitalia slide no. 8218 [Petersen]; BMNH).

Tinea hongorella Zagulajev

Tinea hongorella Zagulajev, 1975, *Insects Mongolia* **3**: 338, figs 1–5. Holotype ♂, MONGOLIA: Bayan Khongorsk aimak, N. slope of Tsagan Bogdo-Ula, 1500 m, viii.1969 (*Gur'eva*) (ZI, Leningrad) [examined].

♂. [Description adapted from Zagulajev, 1975.] 10 mm. Head straw-yellow. Maxillary palpus yellowish grey, elongate, only slightly shorter than labial palpus. Galea not reaching tip of second segment of labial palpus. Antenna smooth, brownish grey. Fore wing yellowish grey dusted with ochre, glossy; discocellular spot ill-defined. Hind wing glossy, slightly broader and brighter than fore wing; fringes glossy, straw-yellow.

♀. Unknown.

GENITALIA ♂. [Description adapted from Zagulajev, 1975.] Saccus length unknown. Valva elongate, costa concave, apex evenly rounded and hardly truncated. Dorsal margin of gnathos angled dorsad at one-third, straight from one-third to four-fifths then slightly concave to apex. Anellus spines small, distributed in a band three or four spines wide. Aedeagus length unknown, comparatively long, with two bands of thorn-like carinae arising from rod-like sclerotizations either side of the apex; vesica without cornuti. Aedeagus/saccus ratio [from Zagulajev's fig. 3] 1.87.

REMARKS. This is a glossy, yellowish species with an ill-defined fore wing pattern. The pattern is not, however, obsolete as in *bothniella*. The structure of the aedeagus is characteristic, cornuti being absent and the lateral lines of carinae being quite unlike those of other members of the *pellionella*-group. The venation of the right fore wing of the holotype is remarkable in that a fourth medial branch (M_4) is present: Zagulajev does not state whether or not the specimen is symmetrical.

Tinea hongorella is only known from the holotype.

BIOLOGY. Unknown. The holotype was collected in August. Zagulajev suggests that, as in allied species, larvae of *hongorella* may feed on substances of animal origin in the nests of birds or rodents.

DISTRIBUTION. Mongolia.

MATERIAL EXAMINED

None.

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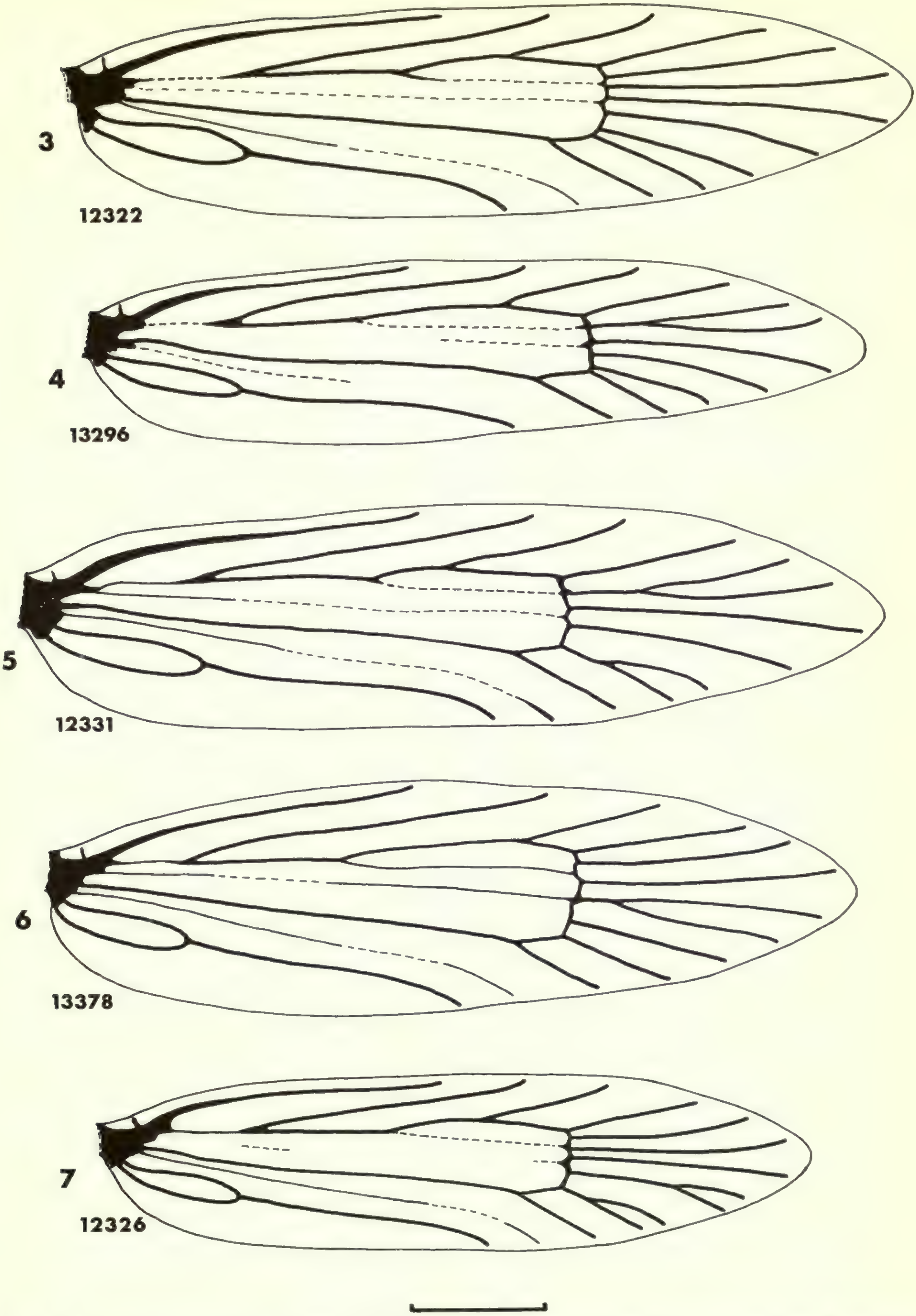
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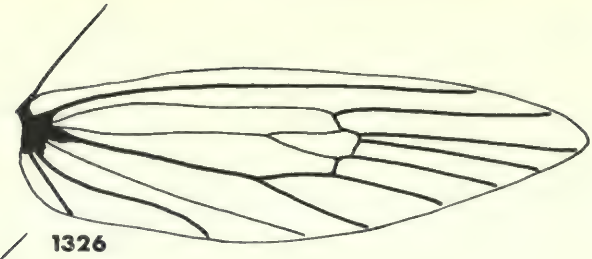
Figs 3–7 Fore wing venation of *Tinea* species. 3, *translucens*, ♂, Britain; 4, *pellionella*, ♀, Britain; 5, *translucens*, ♀, Britain; 6, *flavescentella*, ♀, Britain; 7, *translucens*, ♂, Britain. Scale = 1 mm. Numbers = wing preparation numbers.

8



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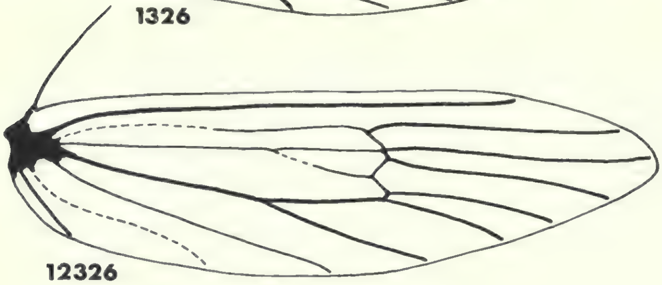

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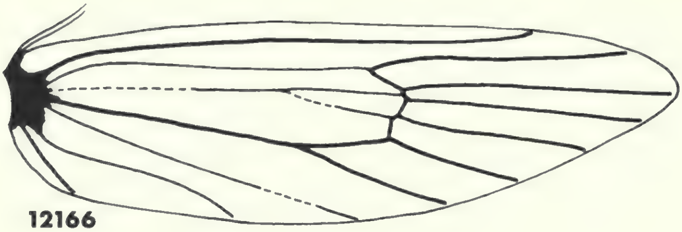

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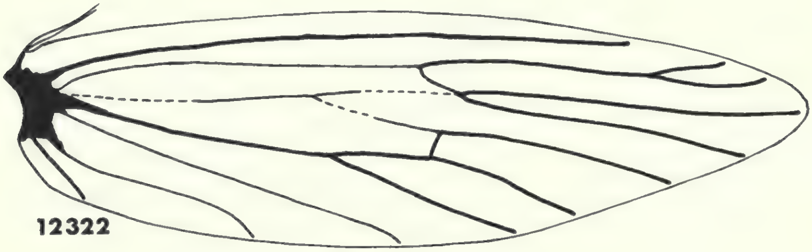

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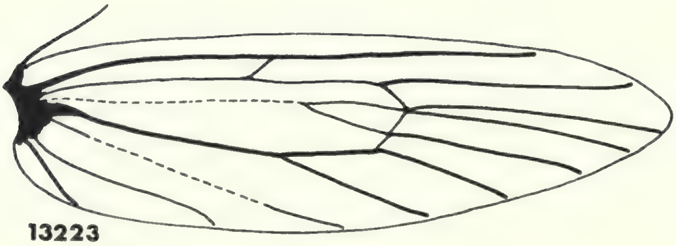


Figs 8–12 Hind wing venation of *Tinea* species. 8, *flavescentella*, ♂, Britain; 9, *translucens*, ♂, Britain; 10, *murariella*, ♀, France; 11, *translucens*, ♀, Britain; 12, *lanella*, ♂, Britain. Scale = 1 mm. Numbers = wing preparation numbers.

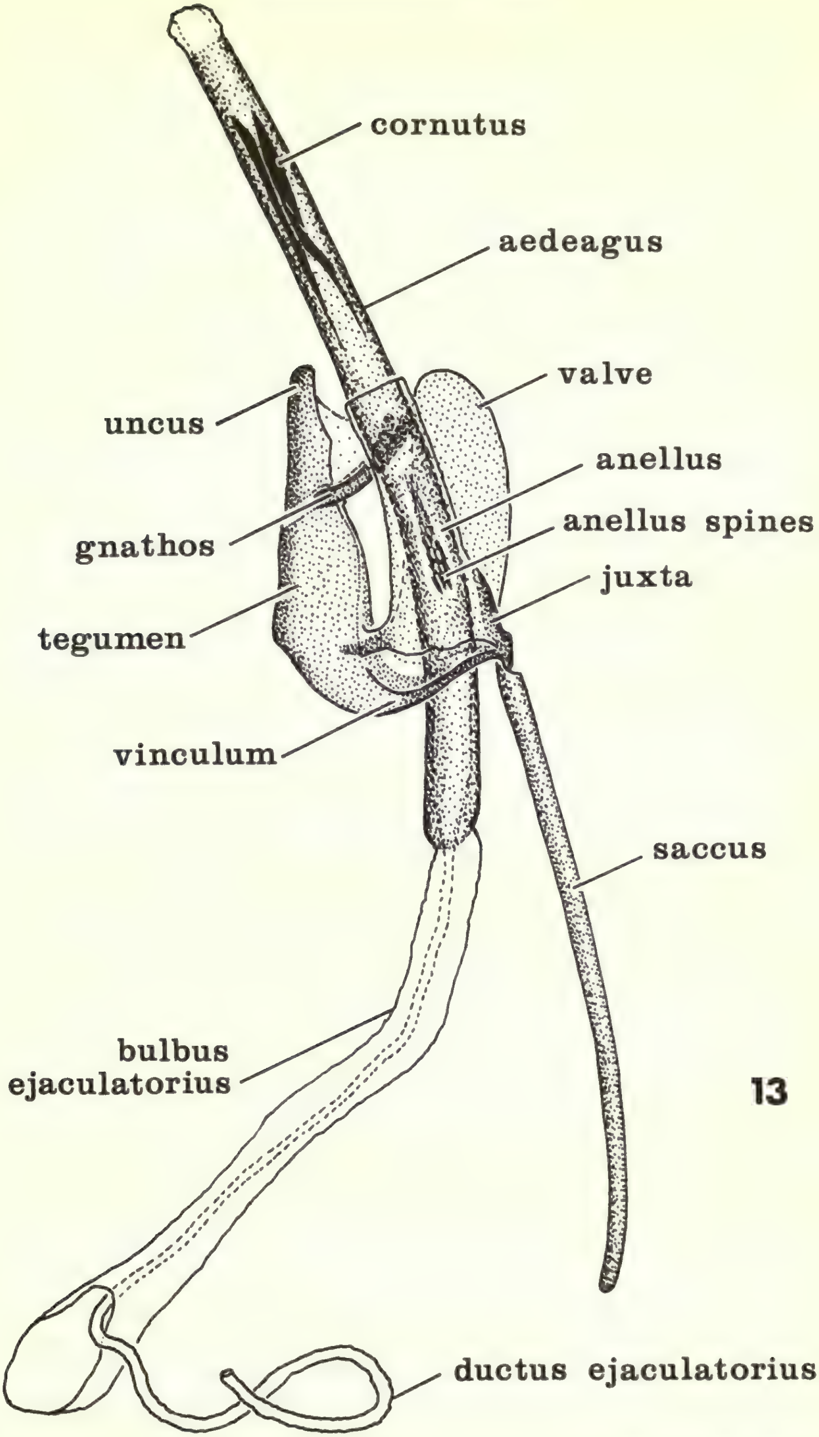
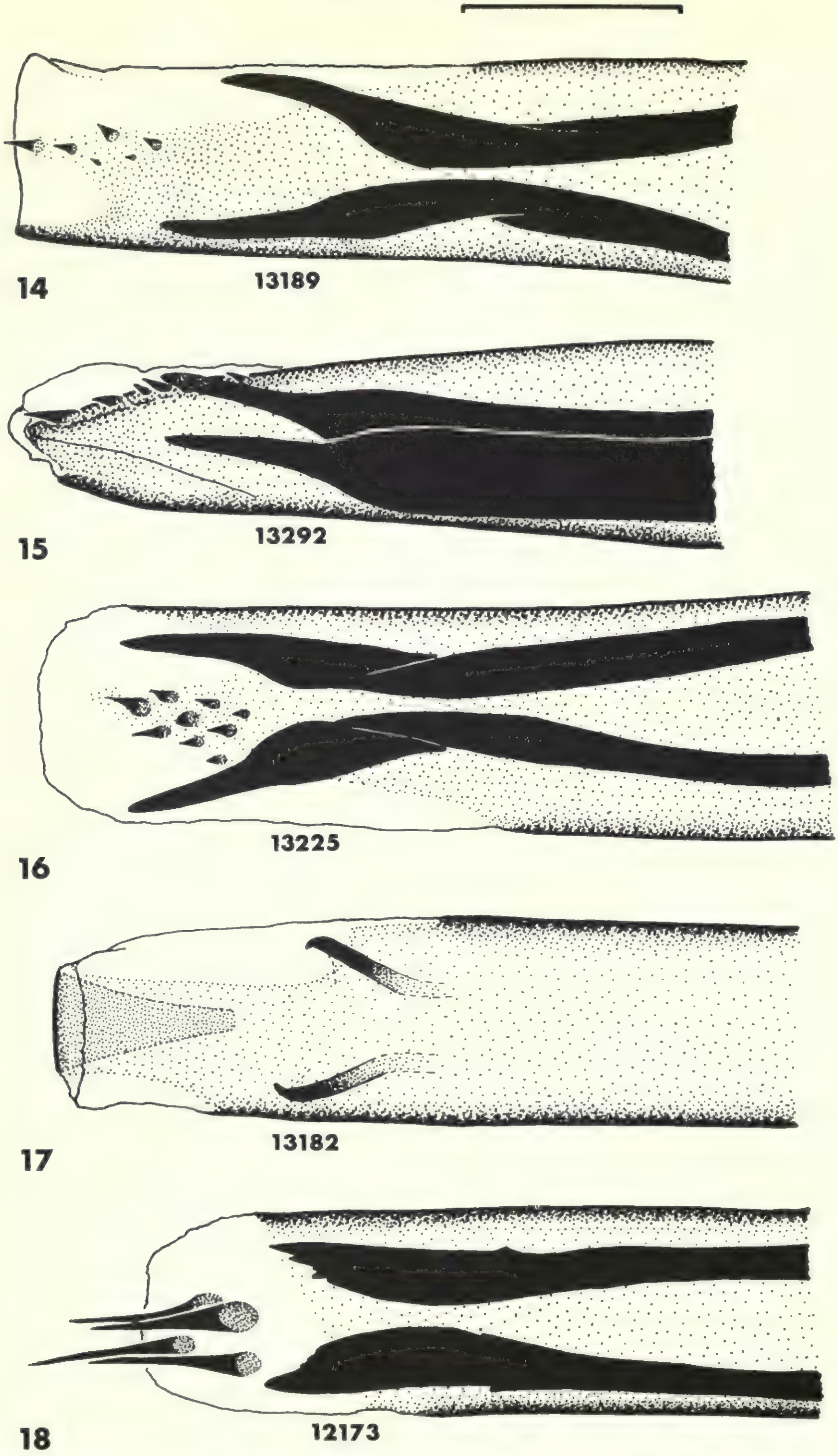

cornutus
aedeagus
valve
uncus
anellus
anellus spines
gnathos
juxta
tegumen
vinculum
saccus
bulbus ejaculatorius
13
ductus ejaculatorius

Fig. 13 Schematic diagram of ♂ genitalia of a species of the *Tinea pellionella* group.


14
13189
15
13292
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13225
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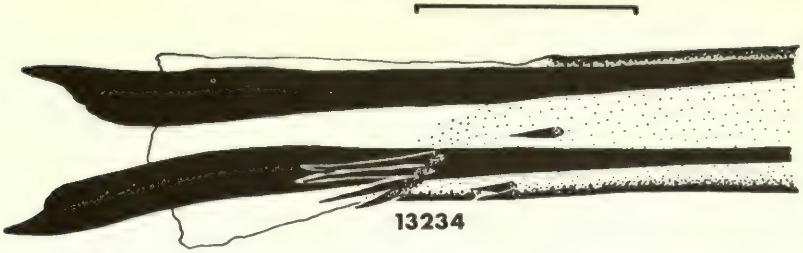
18
12173

Figs 14–18 Tip of aedeagus of *Tinea* species. 14, *pellionella*, Britain; 15, *pellionella*, Britain; 16, *pellionella*, Germany; 17, *dubiella*, Madeira; 18, *translucens*, Britain. Scale = 1 mm. Numbers = genitalia slide numbers.



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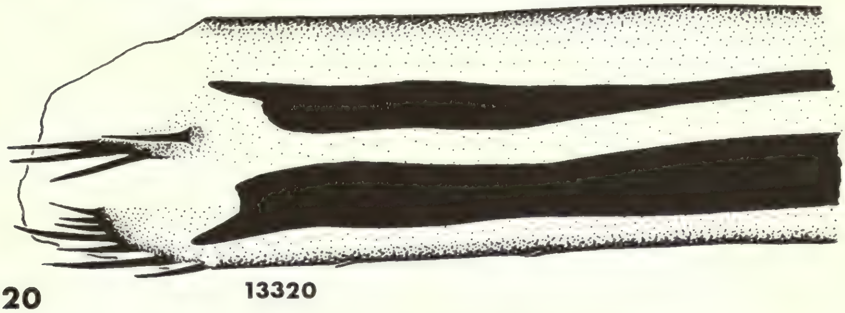

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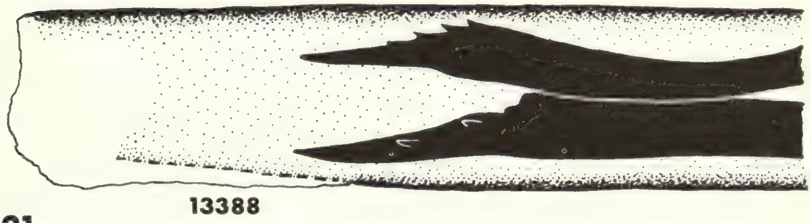

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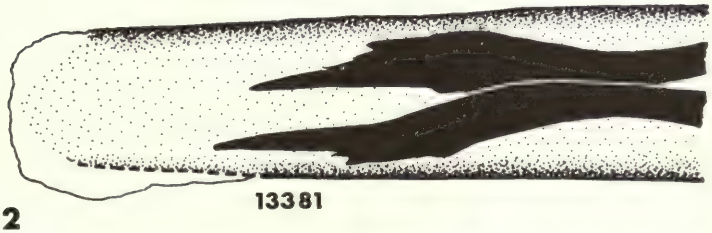

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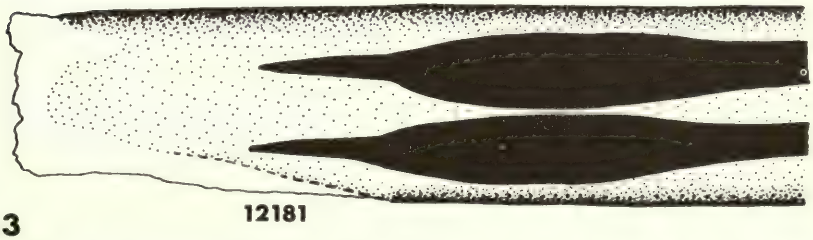
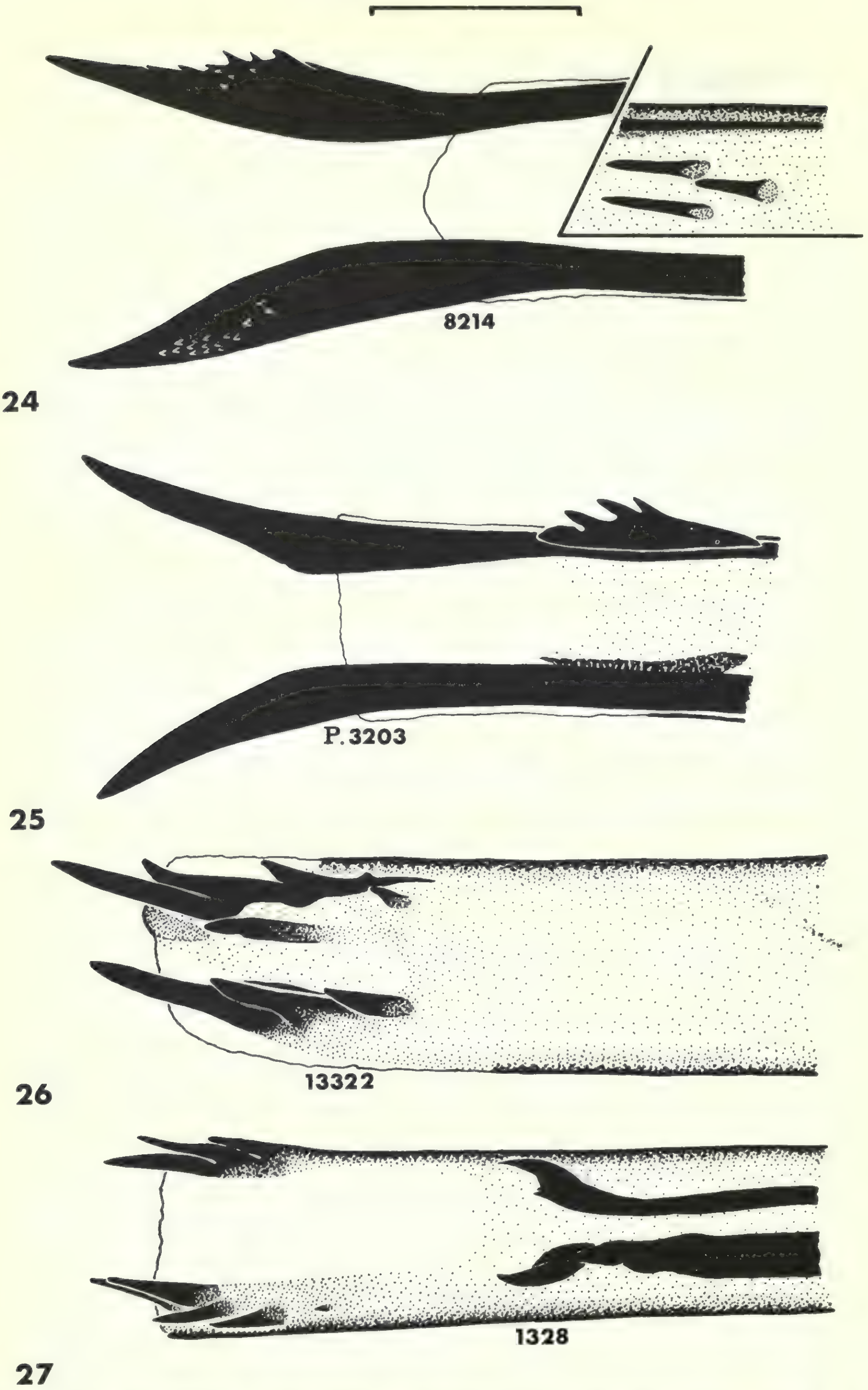
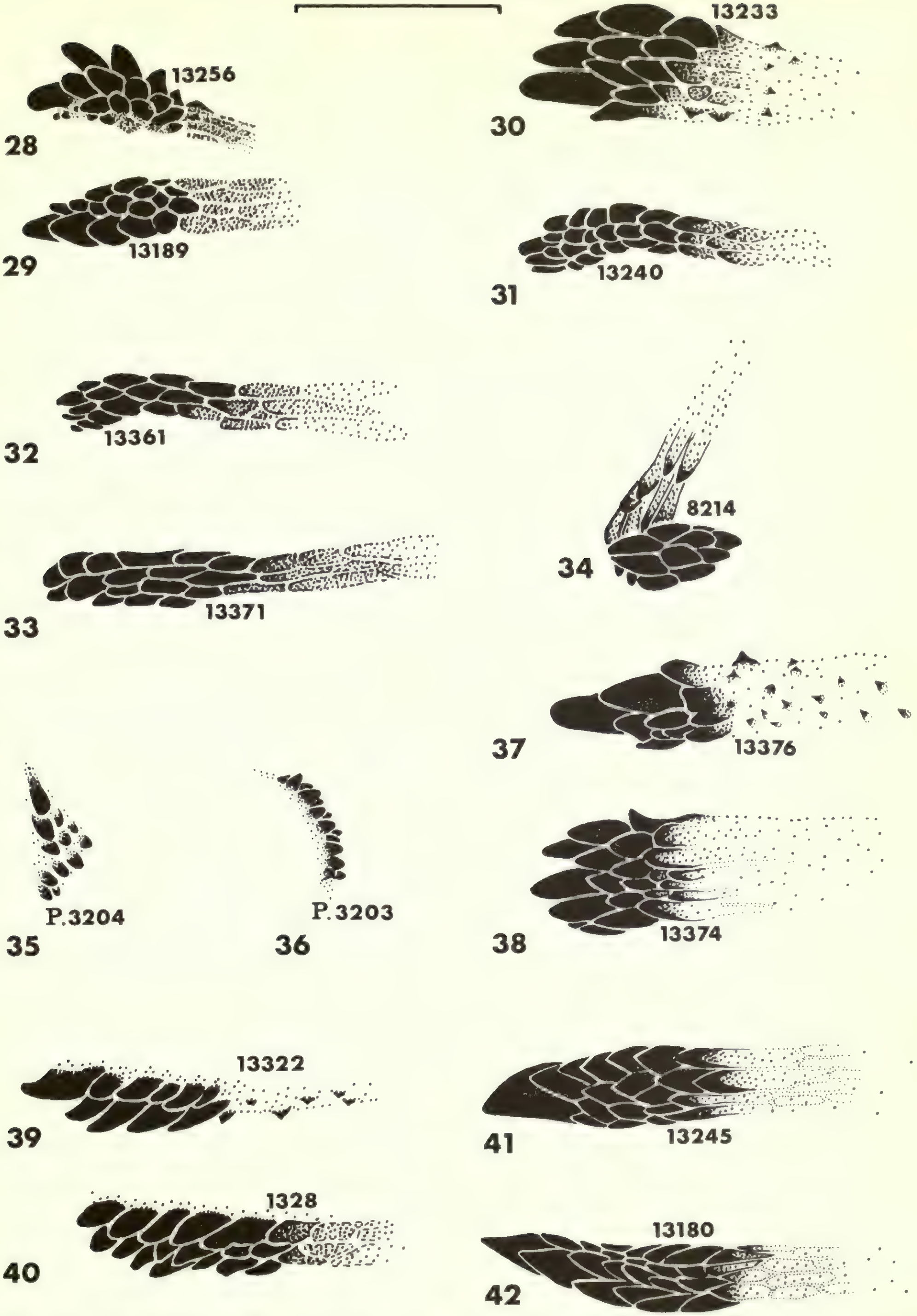


23

Figs 19–23 Tip of aedeagus of *Tinea* species. 19, *translucens*, Japan; 20, *translucens*, Japan; 21, *murariella*, Tenerife; 22, *murariella*, France; 23, *murariella*, France. Scale = 0·1 mm. Numbers = genitalia slide numbers.


8214
24
P.3203
25
13322
26
1328
27

Figs 24–27 Tip of aedeagus of *Tinea* species. 24, *messalina*, holotype, Italy (cornuti inset); 25, *lanella*, paralectotype, Britain; 26, *flavescentella*, Britain; 27, *roesleri*, paratype, South West Africa. Scale = 0·1 mm. Numbers = genitalia slide numbers.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36
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13376
38
13374
13322
39
41
13245
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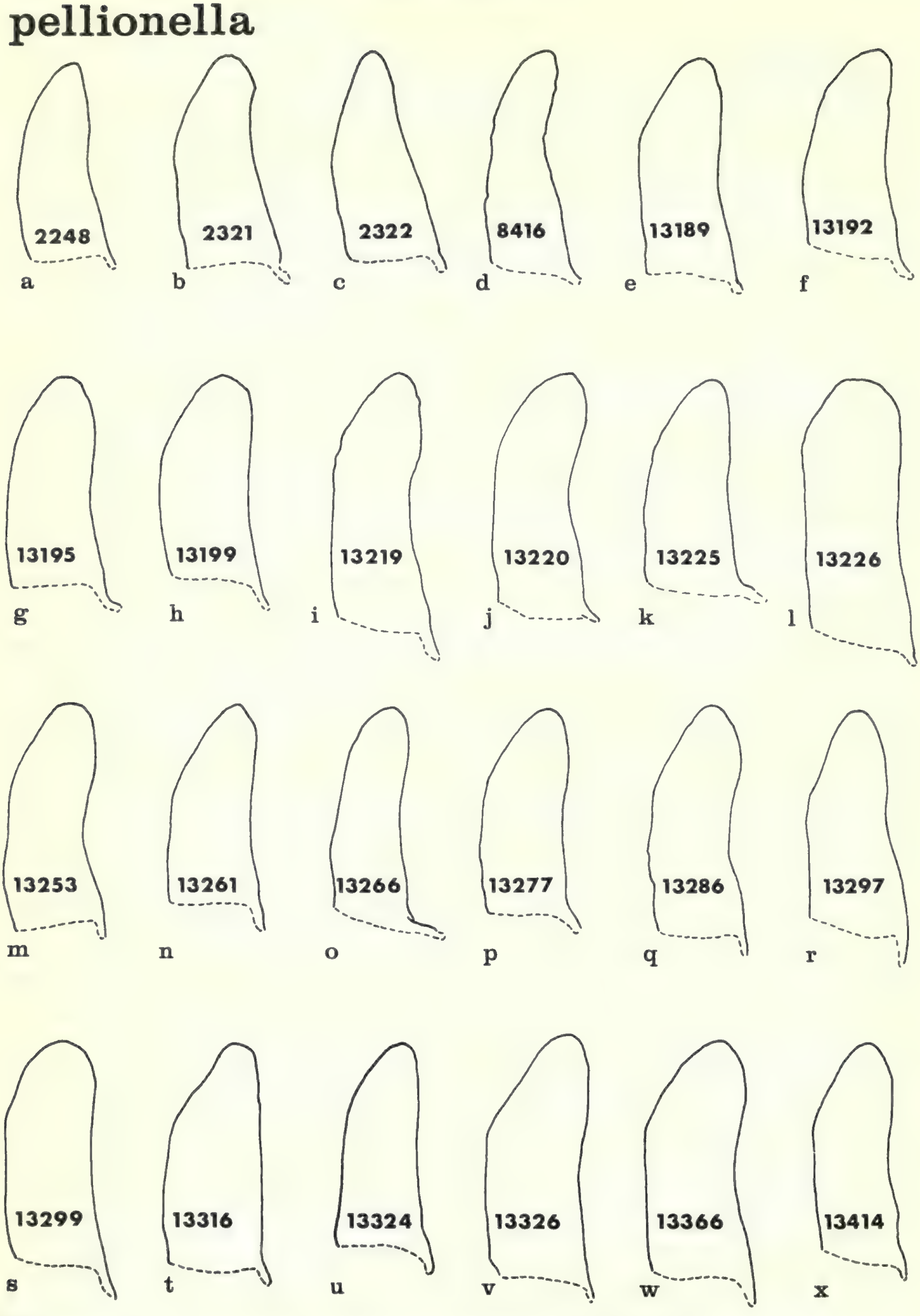
40
13180
42

Figs 28–42 Anellus spines of *Tinea* species. 28, *pellionella*, Switzerland; 29, *pellionella*, Britain; 30, *flavescentella*, Spain; 31, *translucens*, India; 32, *murariella*, Portugal; 33, *murariella*, Algeria; 34, *messalina*, holotype, Italy; 35, *lanella*, lectotype, Britain; 36, *lanella*, paralectotype, Britain; 37, *flavescentella*, Britain; 38, *flavescentella*, Algeria; 39, *flavescentella*, Britain; 40, *roesleri*, South West Africa; 41, *dubiella*, Sikkim; 42, *dubiella*, Spain. Scale = 0·1 mm. Numbers = genitalia slide numbers.


pellionella
2248
a
2321
b
2322
c
8416
d
13189
e
13192
f
13195
g
13199
h
13219
i
13220
j
13225
k
13226
l
13253
m
13261
n
13266
o
13277
p
13286
q
13297
r
13299
s
13316
t
13324
u
13326
v
13366
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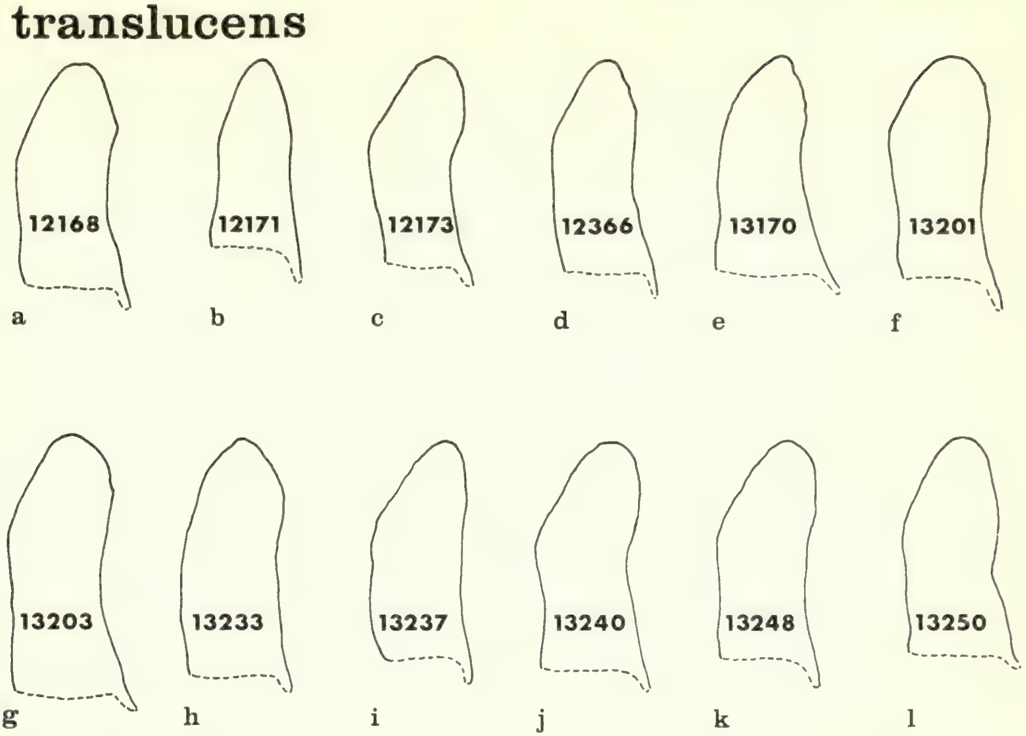
13414
x

43

Fig. 43 Variation in outline of left valva in (a–x) 24 specimens of *Tinea pellionella*. Scale = 1 mm. Numbers = genitalia slide numbers.


translucens
12168
a
12171
b
12173
c
12366
d
13170
e
13201
f
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g
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h
13237
i
13240
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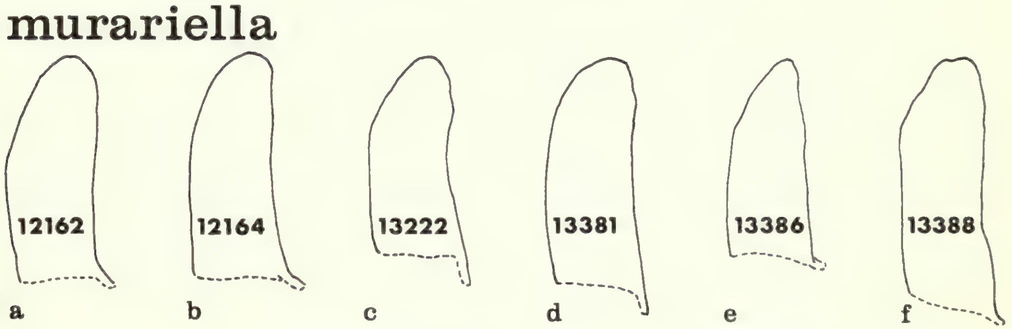
k
13250
l

44


murariella
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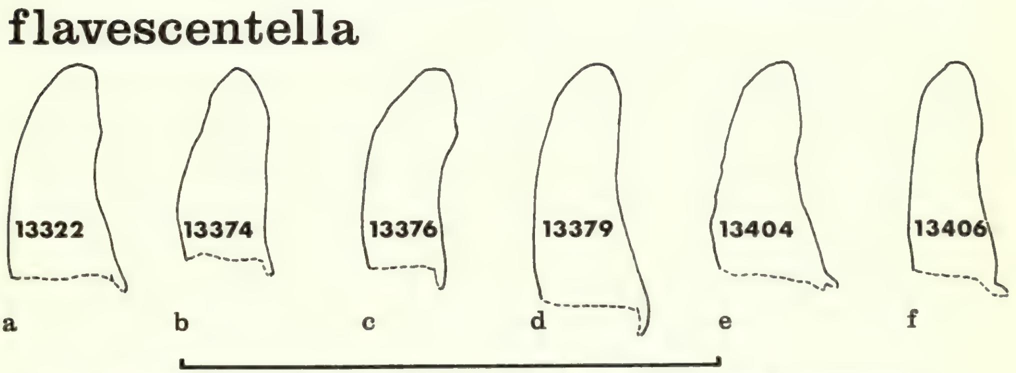
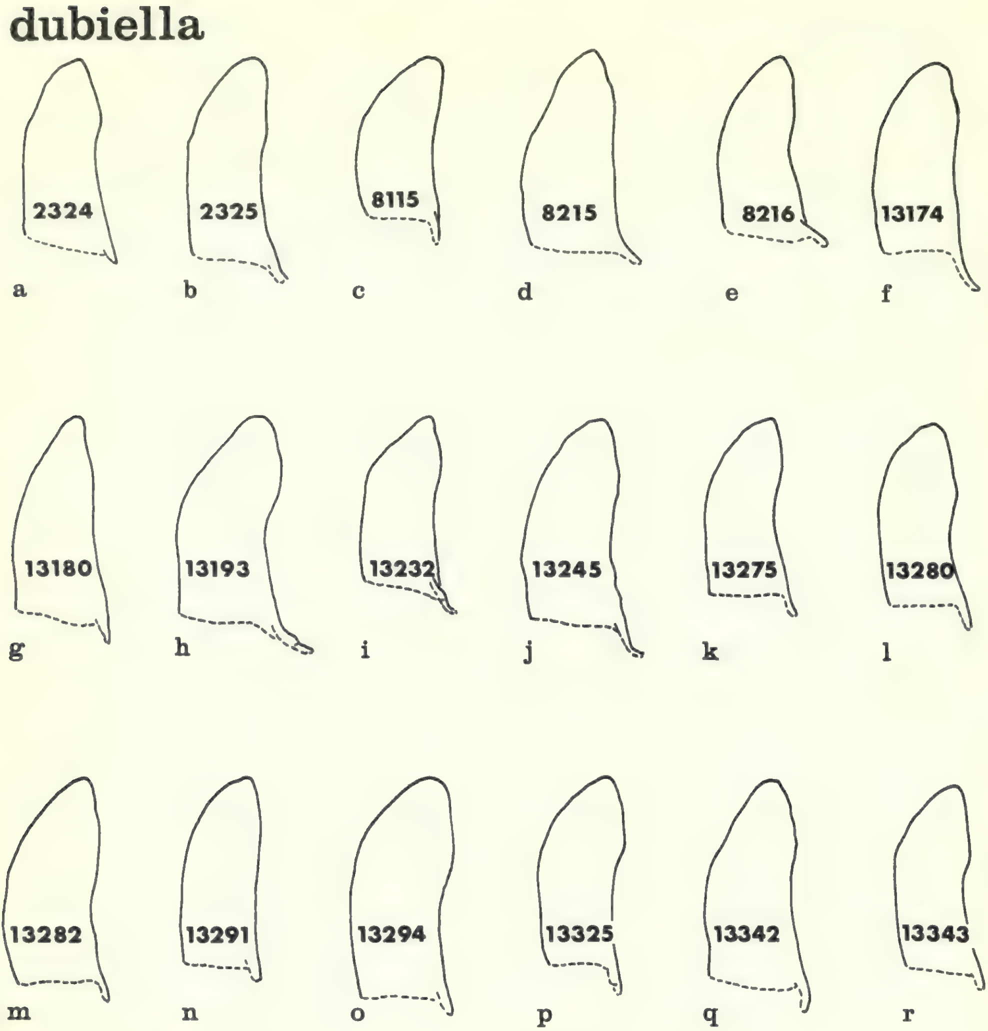
a
12164
b
13222
c
13381
d
13386
e
13388
f

45


flavescentella
13322
a
13374
b
13376
c
13379
d
13404
e
13406
f

46

Figs 44–46 Variation in outline of left valva in *Tinea* species. 44a–l, *translucens*; 45a–f, *murariella*; 46a–f, *flavescentella*. Scale = 1 mm. Numbers = genitalia slide numbers.


dubiella
2324
a
2325
b
8115
c
8215
d
8216
e
13174
f
13180
g
13193
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13232
i
13245
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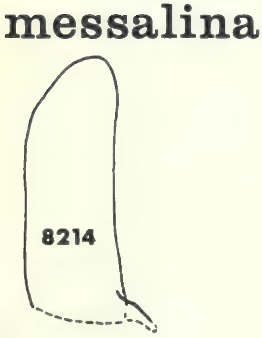
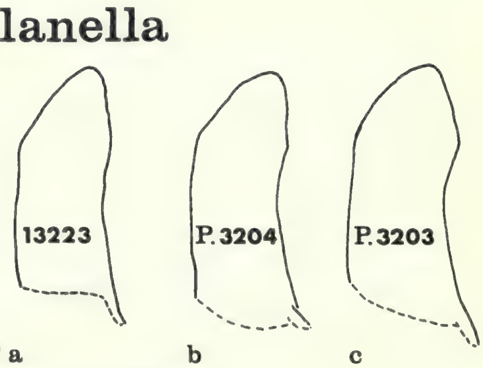
p
13342
q
13343
r

47


messalina
8214

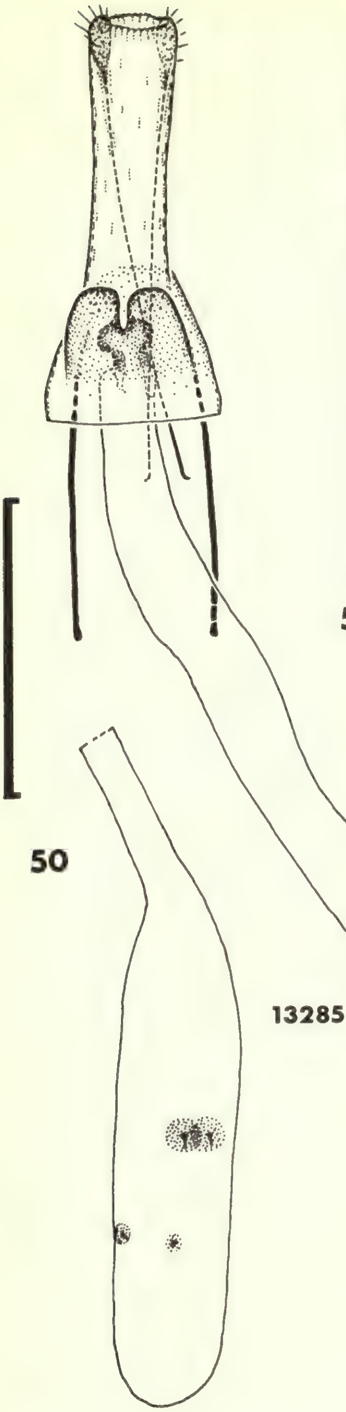
48

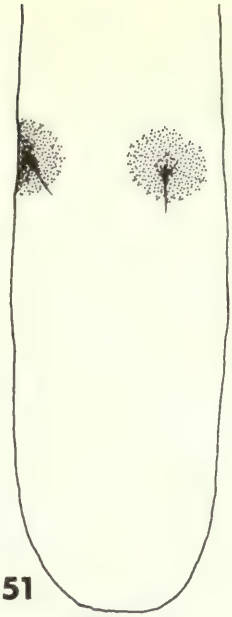

lanella
13223
a
P.3204
b
P.3203
c

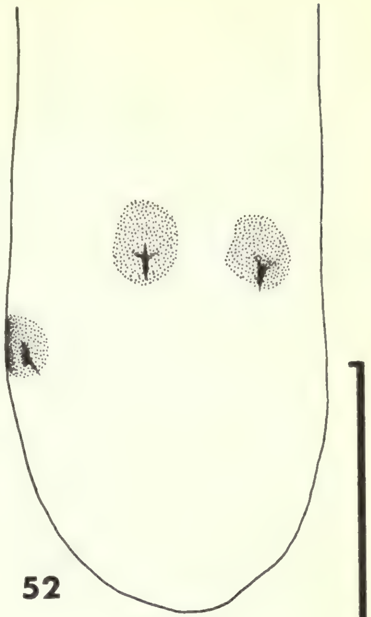
49

Figs 47, 49 Variation in outline of left valva of *Tinea* species. 47a–r, *dubiella*; 49a–c, *lanella*. Scale = 1 mm. Numbers = genitalia slide numbers.

Fig. 48 Outline of left valva of holotype of *Tinea messalina*, Italy. Scale = 1 mm. Number = genitalia slide number.







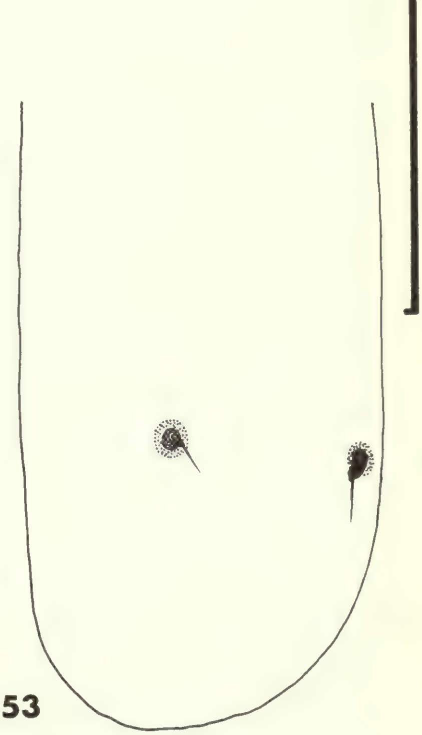


Fig. 50 Female genital armature of *Tinea pellionella*, Britain. Scale = 1 mm.

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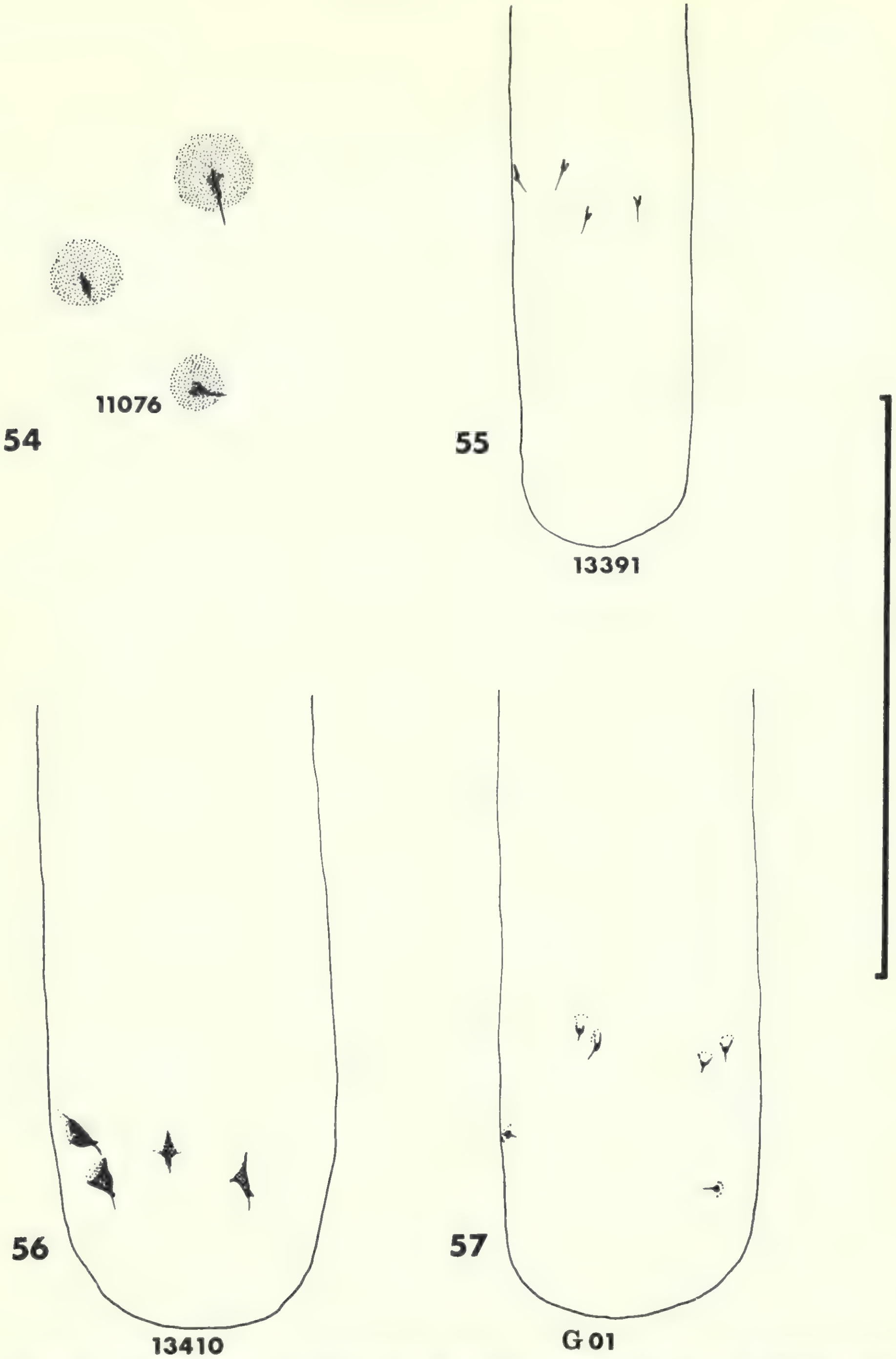

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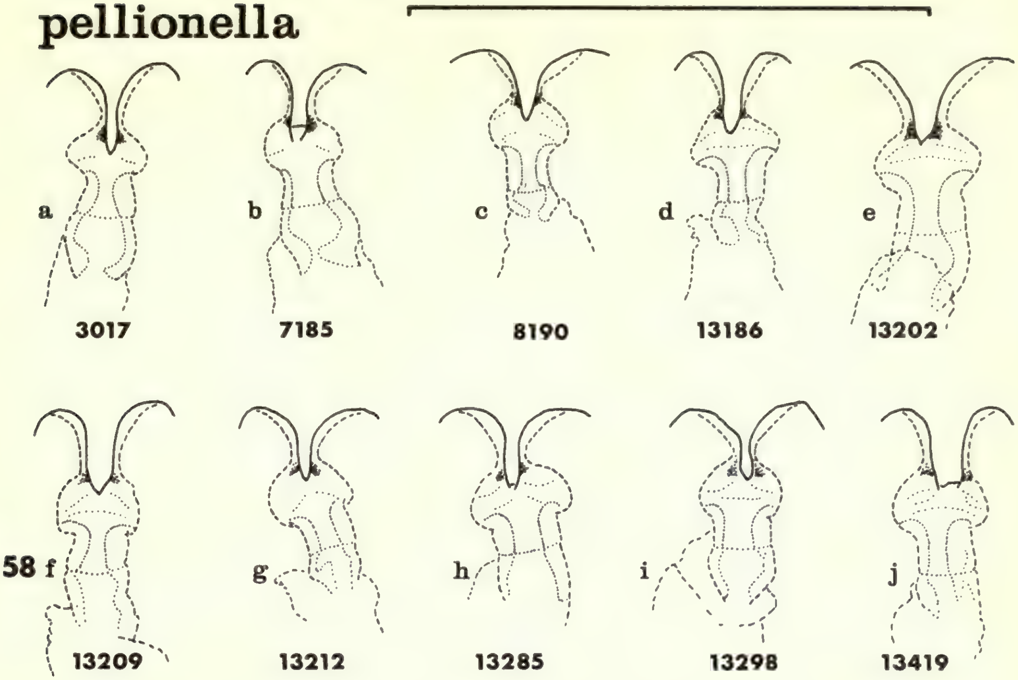
pellionella


a
3017
b
7185
c
8190
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58 f
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13212
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13285
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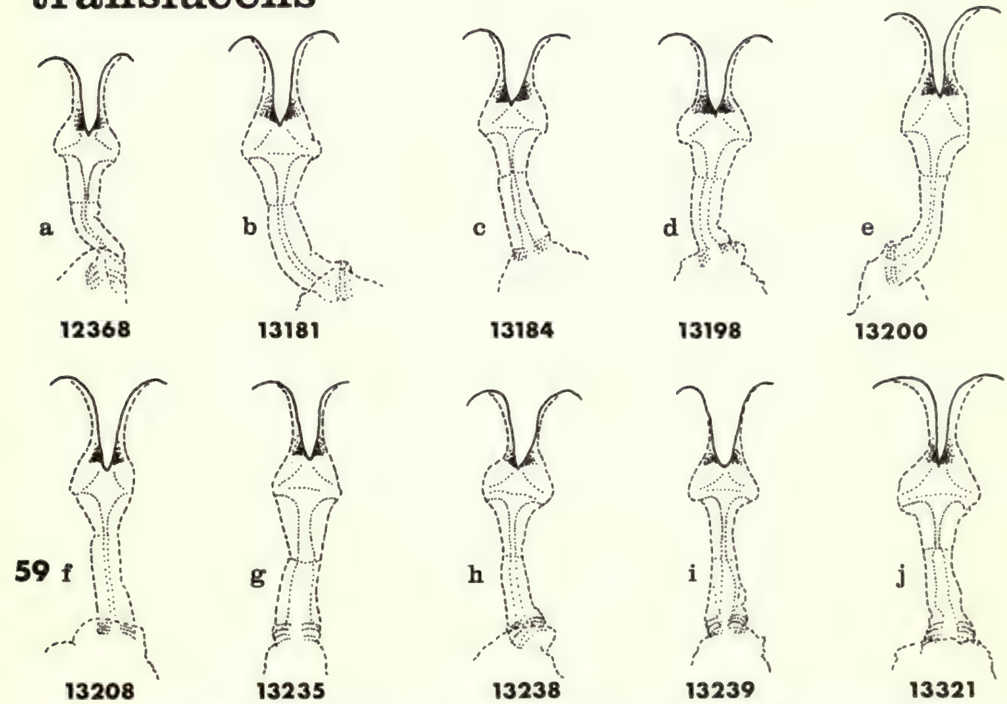
13298
j
13419

translucens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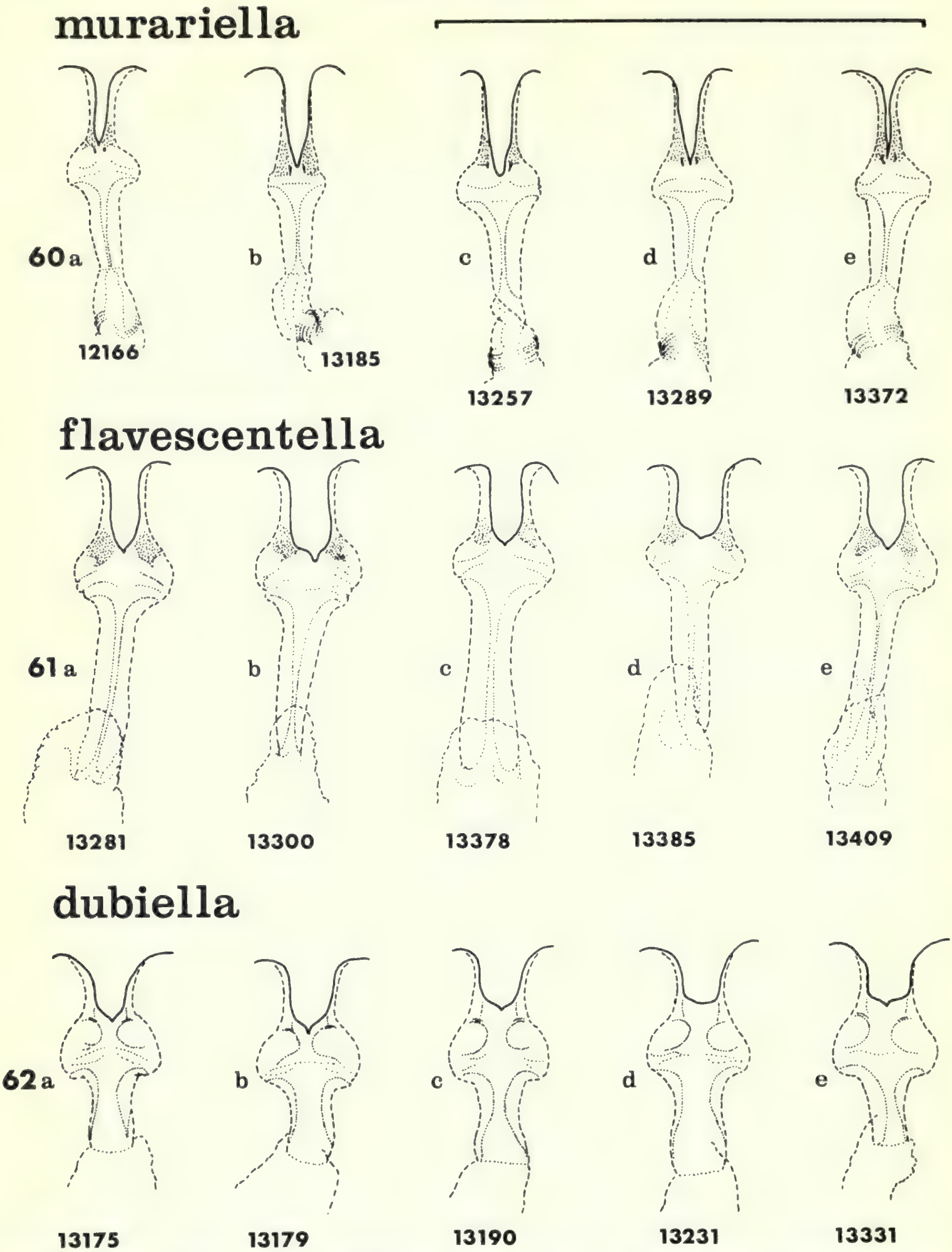
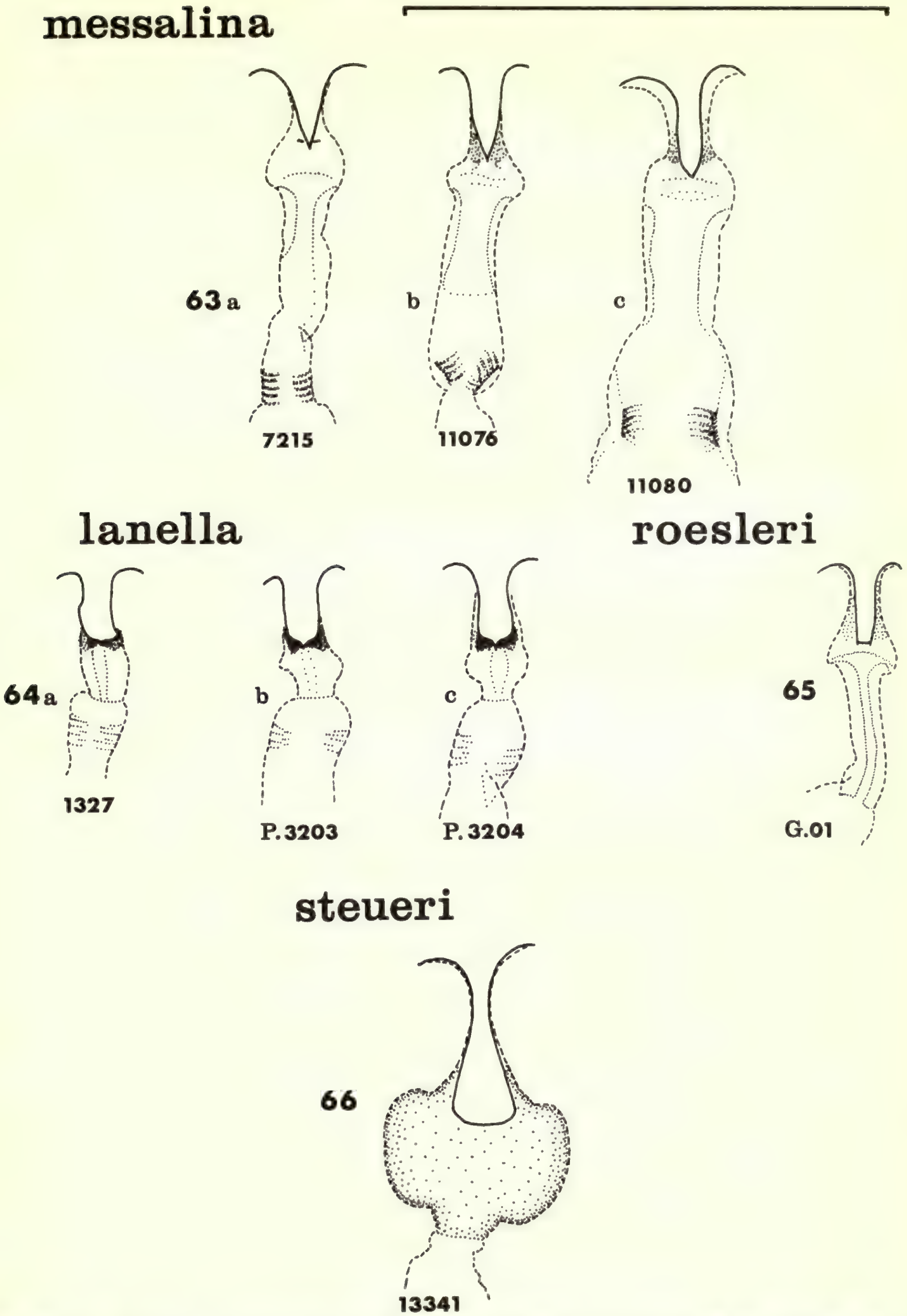
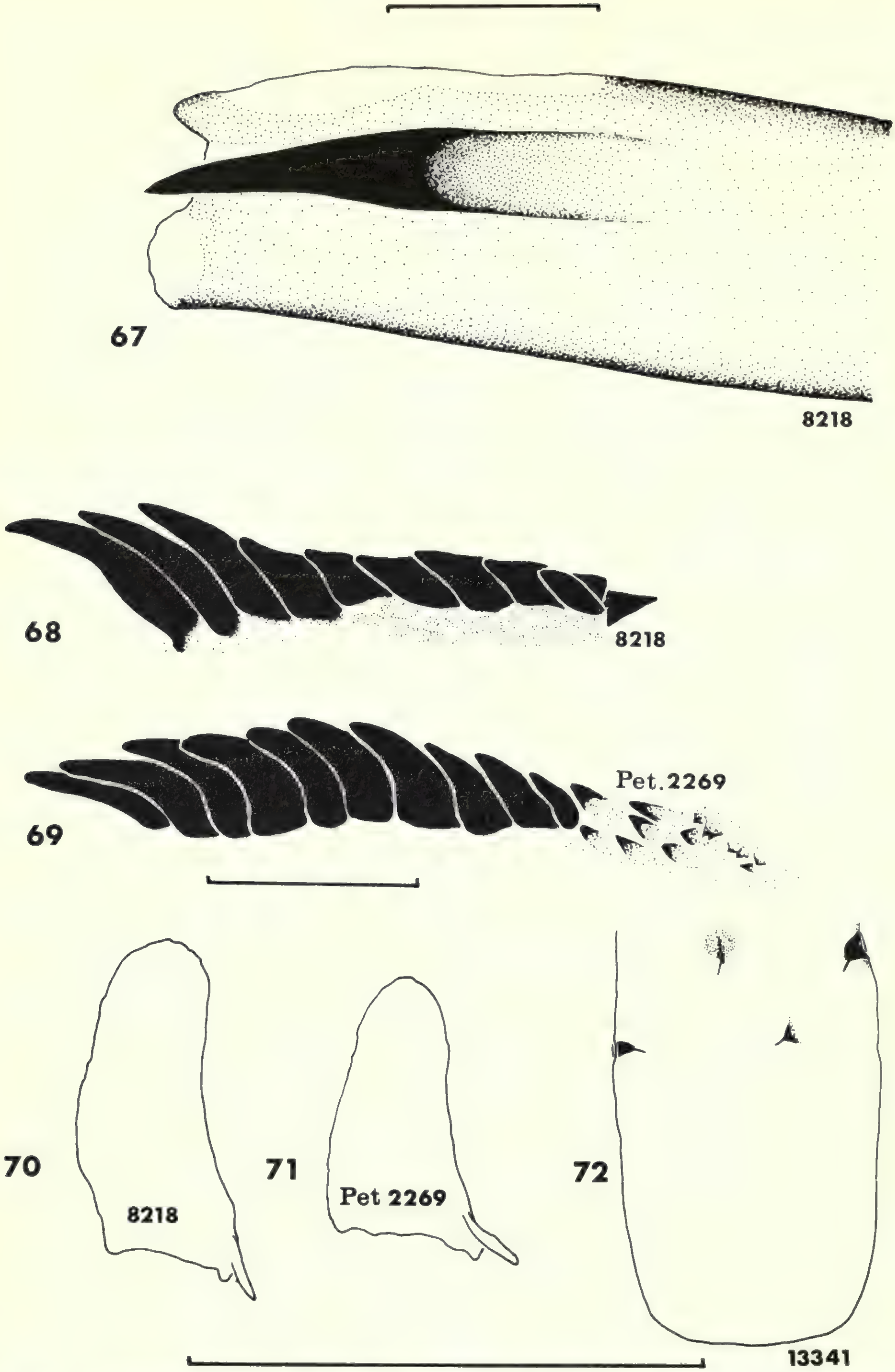

murariella
60a
b
c
d
e
12166
13185
13257
13289
13372
flavescentella
61a
b
c
d
e
13281
13300
13378
13385
13409
dubiella
62a
b
c
d
e
13175
13179
13190
13231
13331

Figs 60–62 Outline of posterior margin of eighth sternite and antrum of *Tinea* species. 60a–e, *murariella*; 61a–e, *flavescentella*; 62a–e, *dubiella*. Scale = 1 mm. Numbers = genitalia slide numbers.


messalina
63a
b
c
7215
11076
11080
lanella
roesleri
64a
b
c
1327
P.3203
P.3204
65
G.01
steueri
66
13341

Figs 63–66 Outline of posterior margin of eighth sternite and antrum of *Tinea* species. 63a–c, *messalina*; 64a–c, *lanella*; 65, *roesleri*; 66, *steueri*. Scale = 1 mm. Numbers = genitalia slide numbers.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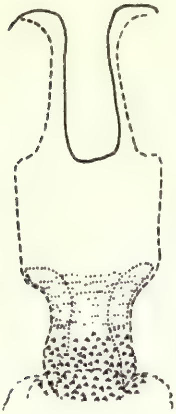
bothniella

73



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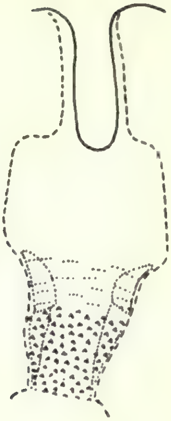

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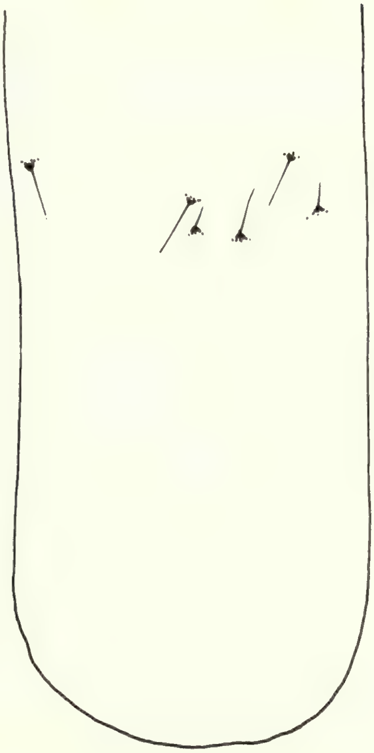

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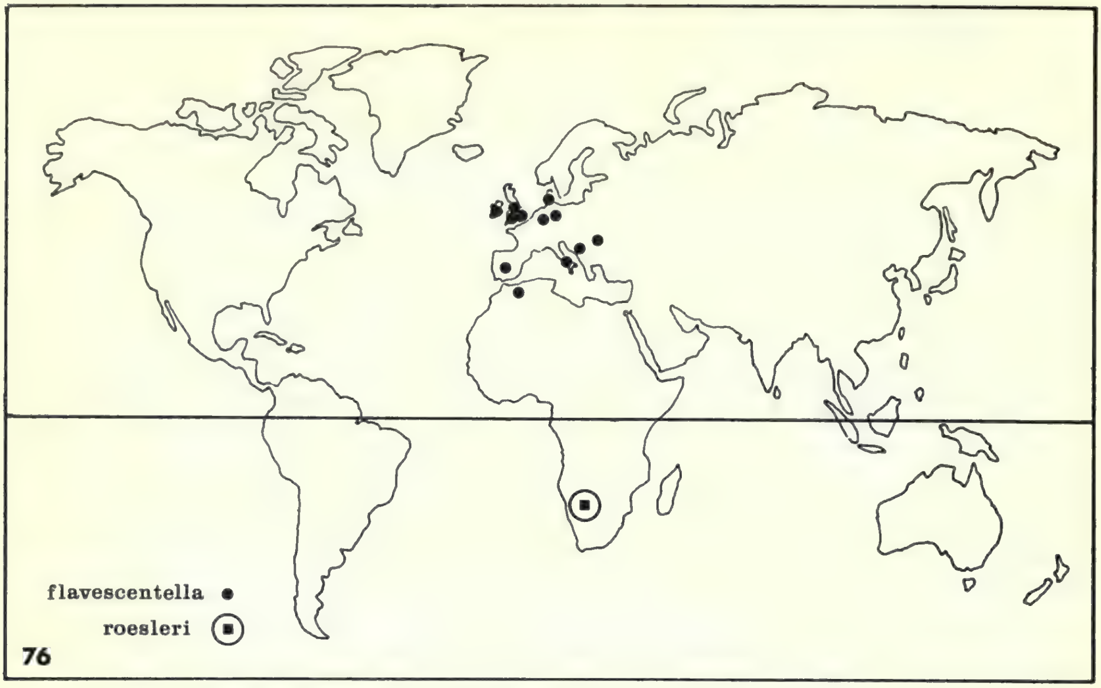
flavescentella ●
roesleri ⊡
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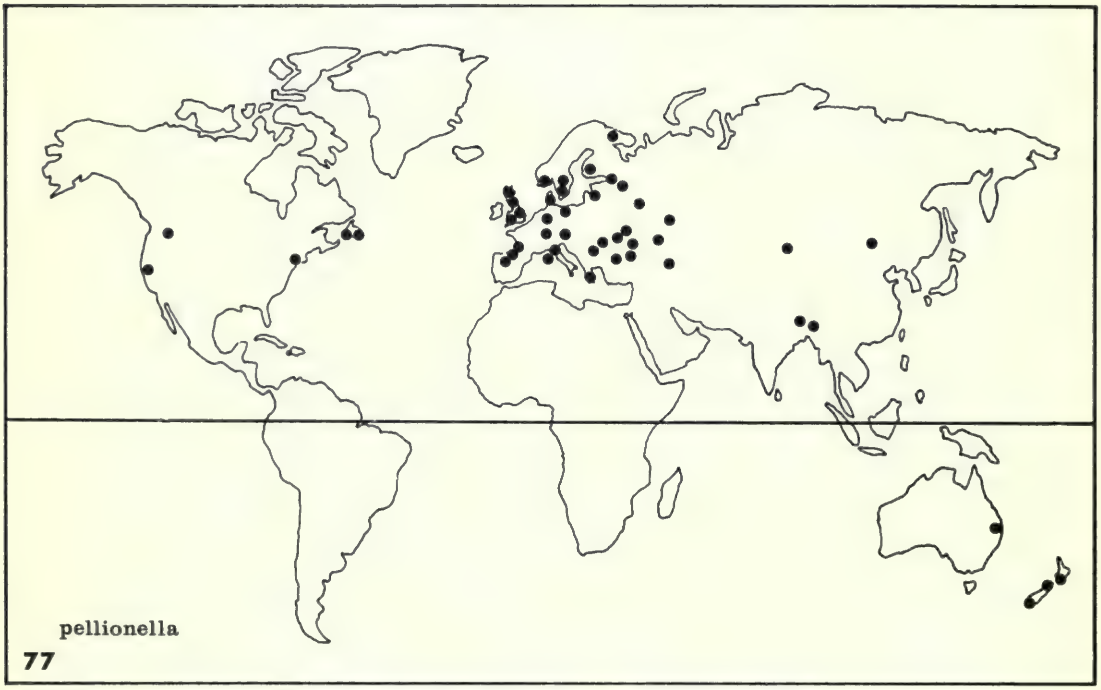
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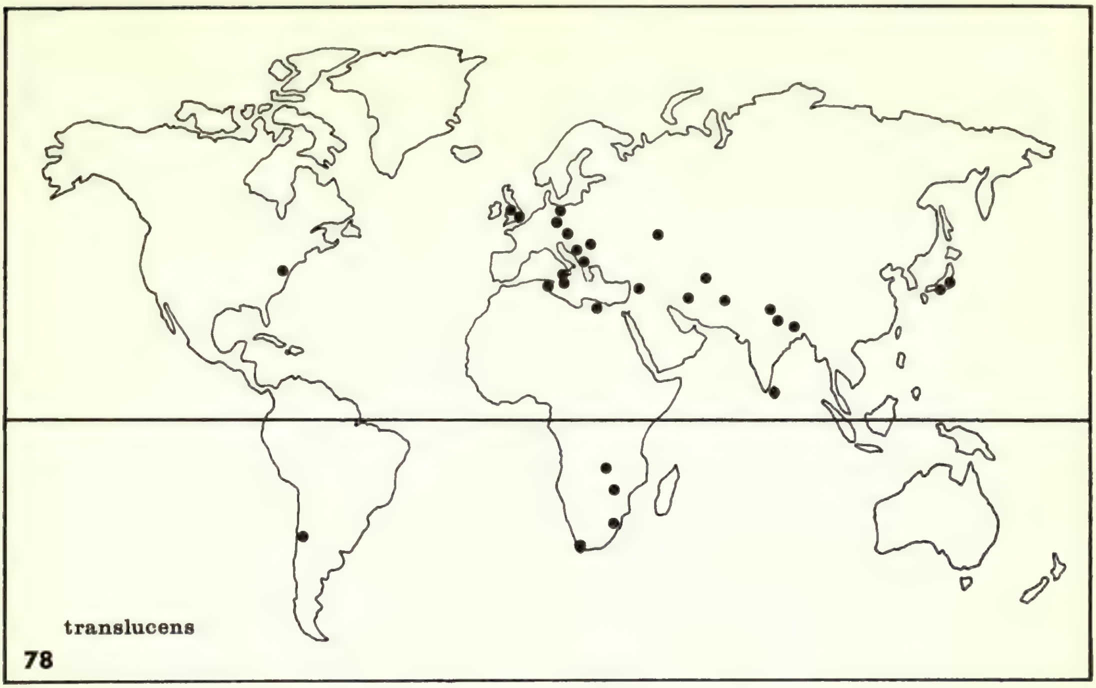
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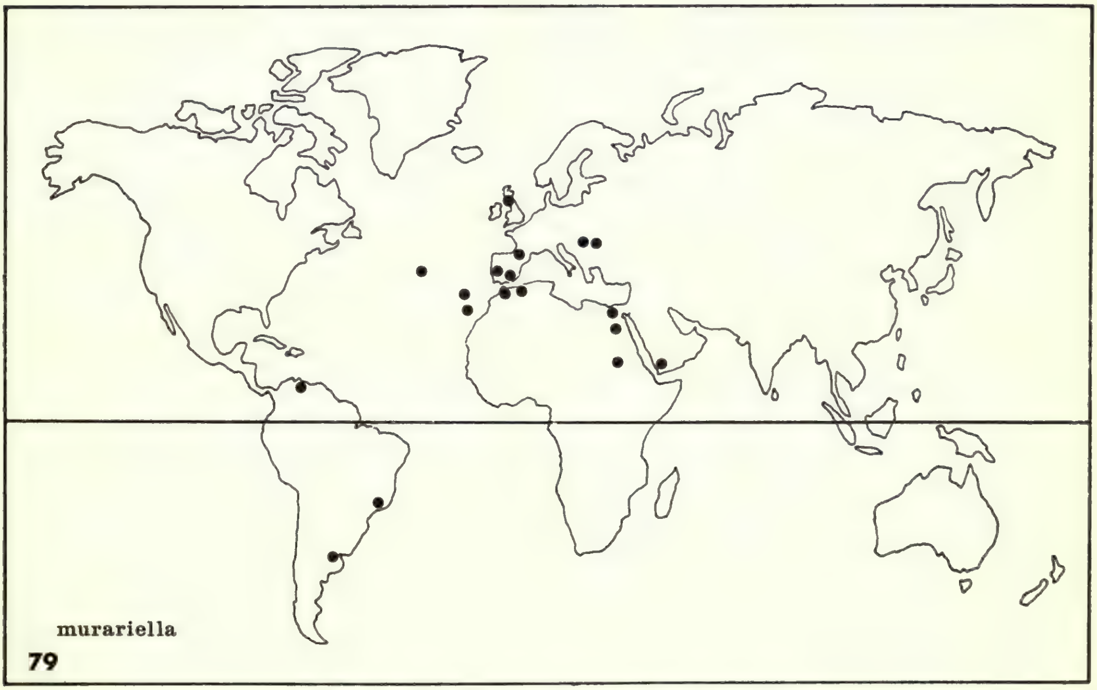
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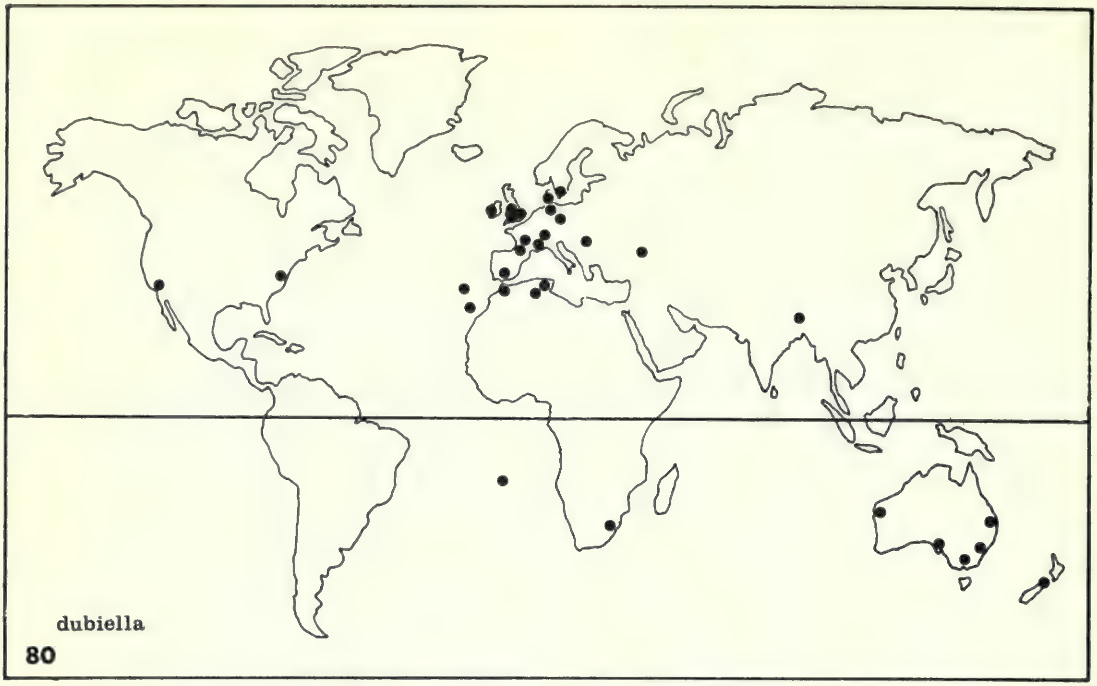
dubiella
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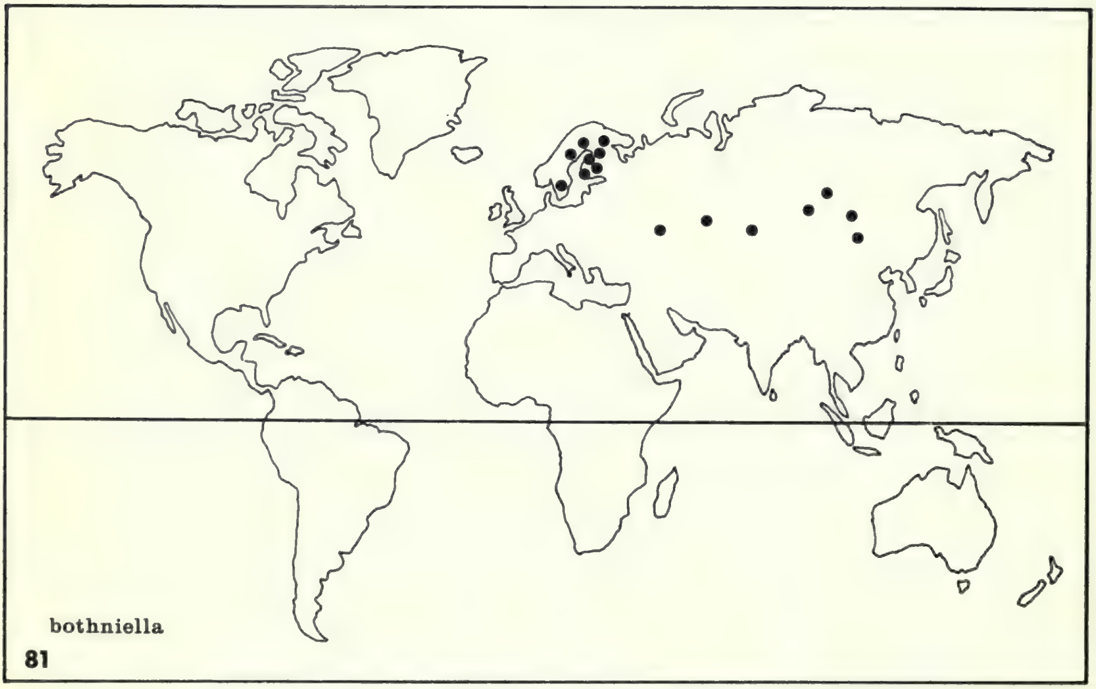
bothniella
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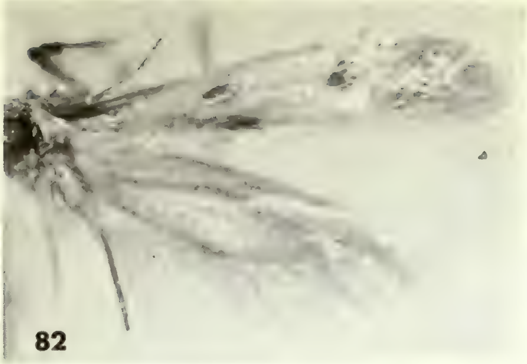
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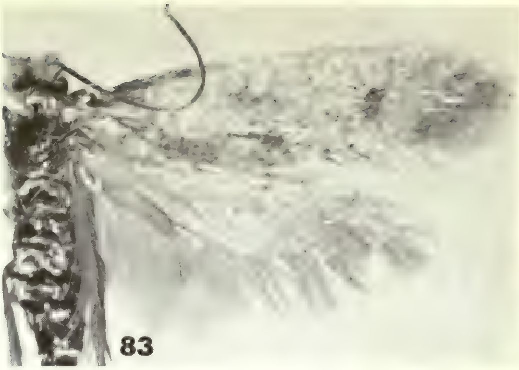
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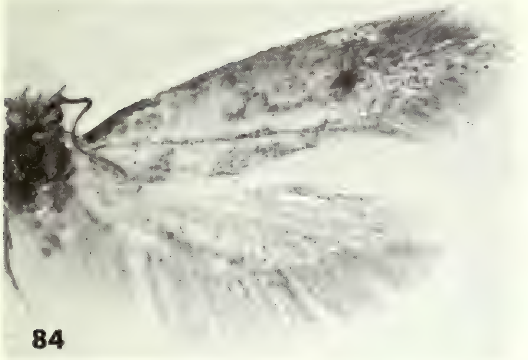
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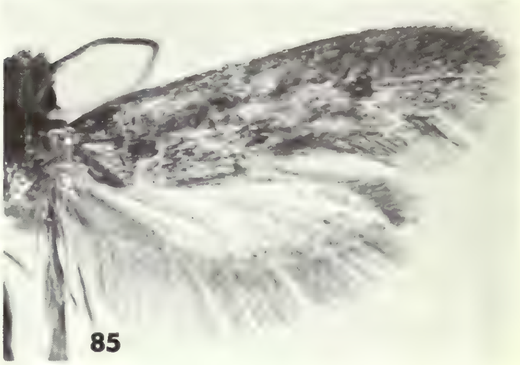
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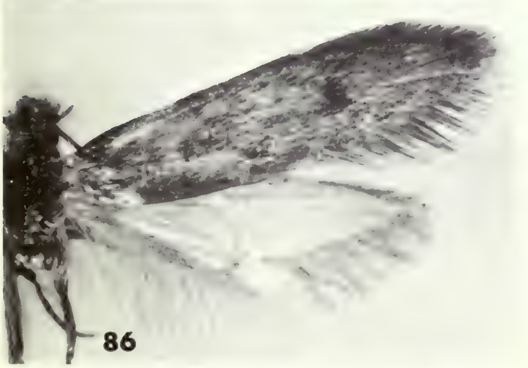
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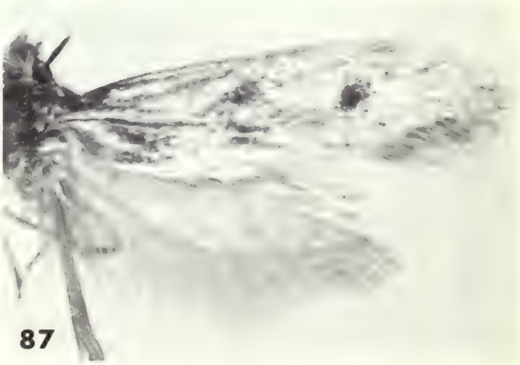
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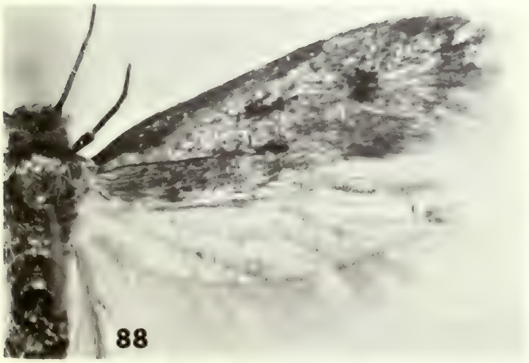
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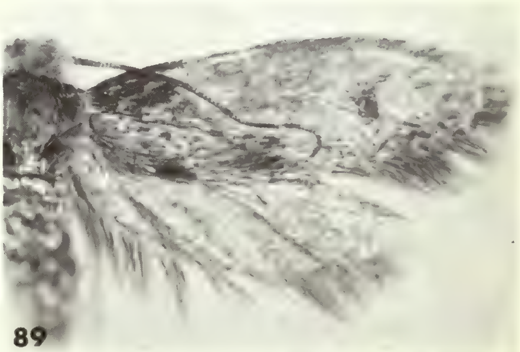
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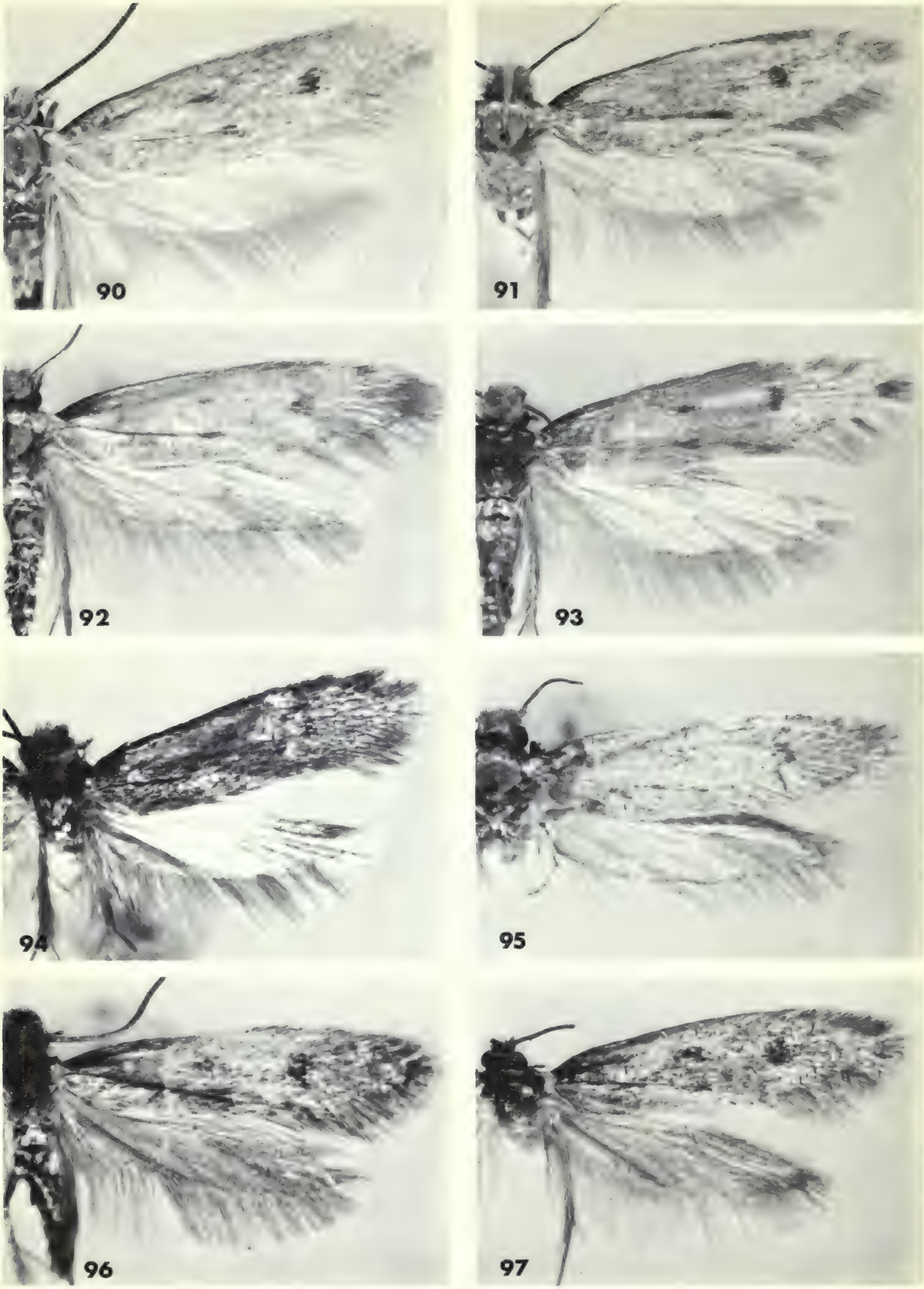

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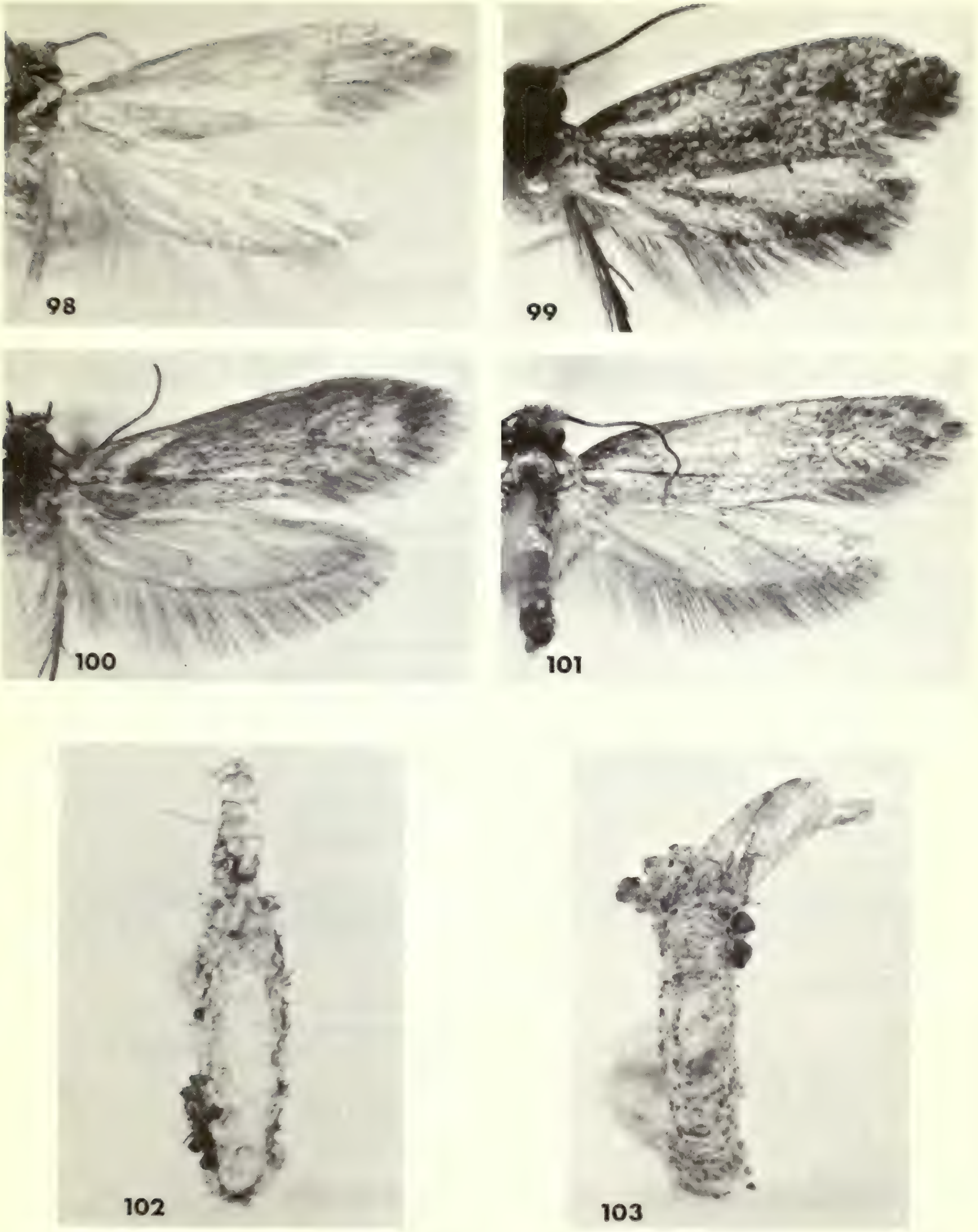

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The genus *Tetramorium* Mayr in the Malagasy region and in the New World

Barry Bolton

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GENERAL

The ant tribe Tetramoriini (Hymenoptera: Formicidae)

The genus *Tetramorium* Mayr in the Malagasy region and in the New World

Barry Bolton

Department of Entomology, British Museum (Natural History), Cromwell Road, London SW7 5BD

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Synopsis

The ant genus *Tetramorium* (=*Xiphomyrmex*) is revised for the Malagasy region and the New World, separate keys being given for each. Thirty-six species (29 endemic) are recorded from Madagascar of which 15 are described here as new; five new synonyms are established. Eleven valid species are recognized as occurring in the New World, of which four are endemic; two species are newly described and six new synonyms established in this section. Additions and corrections to the first two parts of this study are included.

Introduction

This is the third part of a series of papers covering the taxonomy of the ant tribe Tetramoriini. Part one (Bolton, 1976) defined the tribe and its constituent genera and reviewed or revised the

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smaller genera. The second part (Bolton, 1977) dealt with the genus *Tetramorium* in the Oriental, Indo-Australian and Australasian regions and this present part covers the faunas of the Malagasy region and the New World. A fourth part, at present in preparation, will deal with the genus *Tetramorium* in the Ethiopian region, by far the largest fauna with over 150 species known to date.

The Malagasy fauna consists of 36 known species and has not previously been monographed, whilst the New World has 11 species, four of which are endemic and seven of which are introduced. The New World forms were previously examined by M. R. Smith (1938; 1943), with additional later information from Creighton (1950) and Brown (1957; 1964*a*).

Fuller discussion of the regional faunas is given under their respective sections.

This paper also deals with new species from the Oriental and Indo-Australian regions which have been found since the completion of the second part in 1977, and corrects a couple of errors made in the previous parts.

Measurements and indices

Total Length (TL). The total outstretched length of the individual, from the mandibular apex to the gastral apex.

Head Length (HL). The length of the head proper, excluding the mandibles, measured in a straight line from the anteriormost point of the median clypeal margin to the mid-point of the occipital margin, in full-face view. (In species with a strongly concave occipital margin the head length is measured to the mid-point of a line connecting the posterolateral projections.)

Head Width (HW). The maximum width of the head behind the eyes, measured in full-face view.

Cephalic Index (CI). $\frac{\text{HW} \times 100}{\text{HL}}$

Scape Length (SL). The straight-line length of the antennal scape excluding the basal constriction or neck close to the articulating condylar bulb.

Scape Index (SI). $\frac{\text{SL} \times 100}{\text{HW}}$

Pronotal Width (PW). The maximum width of the pronotum in dorsal view.

Alitrunk Length (AL). The diagonal length of the alitrunk in lateral view from the point at which the pronotum meets the cervical shield to the posterior base of the metapleural lobes or teeth.

All measurements are expressed in millimetres.

Abbreviations of museums

AMNH, New York	American Museum of Natural History, New York, U.S.A.
BMNH	British Museum (Natural History), London, U.K.
CAS, San Francisco	California Academy of Sciences, San Francisco, California, U.S.A.
IE, Bologna	Istituto di Entomologia del'Università, Bologna, Italy
LACM, Los Angeles	Los Angeles County Museum of Natural History, Los Angeles, California, U.S.A.
MCSN, Genoa	Museo Civico di Storia Naturale 'Giacomo Doria', Genoa, Italy
MCZ, Cambridge	Museum of Comparative Zoology, Cambridge, Mass., U.S.A.
MHN, Geneva	Muséum d'Histoire Naturelle, Geneva, Switzerland
NM, Basle	Naturhistorisches Museum, Basle, Switzerland
NM, Vienna	Naturhistorisches Museum, Vienna, Austria
UM, Oxford	University Museum, Oxford, U.K.
USNM, Washington	United States National Museum, Washington, D.C., U.S.A.

Diagnosis of *Tetramorium*

TETRAMORIUM Mayr

Tetramorium Mayr, 1855 : 423. Type-species: *Formica caespitum* L., 1758 : 581, by subsequent designation of Girard, 1879 : 1016.

Xiphomyrmex Forel, 1887 : 385 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Xiphomyrmex*) *kelleri* Forel, loc. cit.; by subsequent designation of Wheeler, 1911 : 175. [Synonymy by Bolton, 1976 : 359.]

For a full statement of the generic synonymy of *Tetramorium* (=*Tetrogmus* Roger, =*Xiphomyrmex* Forel, =*Atopula* Emery, =*Macromischoides* Wheeler, =*Sulcomyrmex* Kratochvíl, =*Lobomyrmex* Kratochvíl) see Bolton, 1976 : 359–365.

DIAGNOSIS OF WORKER AND FEMALE. Myrmicine ants of the tribe Tetramoriini which have the following combination of characters. Mandibles with 2–3 enlarged apical teeth followed by a row of 4 (rarely more) denticles, so that at least 6 (usually 7) teeth are present altogether. Sting with an apical or apicodorsal translucent lamelliform appendage which may be spatulate, triangular, dentiform or pennant-shaped. Lateral portions of clypeus raised into a sharp ridge or shielding wall in front of the antennal insertions. Palp formula 4, 3 at maximum. (Usually with this count, very rare reductions to 4, 2; 3, 3 and 3, 2 are known.) Antennae with 11 or 12 segments, with an apical club of 3 segments. Body hairs never regularly branched bifid, trifid or quadrifid, usually simple but very rarely absent or bizarre.

DIAGNOSIS OF MALE. Myrmicine ants of the tribe Tetramoriini which have the following combination of characters. Mandibles dentate. Antennae with 10 or 11 segments, the second funicular an elongate fusion-segment; funiculus filiform. Palp formula 4, 3 at maximum as worker/female. Body hairs as worker/female, never regularly branched.

A more complete definition of the genus has been given previously (Bolton, 1976), along with a discussion of the genus-level synonymy of *Tetramorium*. An abridged version of this synonymy is noted above as in both the regions at present under consideration some species occur to which the generic name *Xiphomyrmex* was formerly applied. During the first part of this study it was found that this name, based only on the reduced antennomere count of 11 in worker and female castes (as opposed to 12), had no significance as it occurred in a number of widely divergent groups whilst other characters of generic significance remained fixed throughout those groups and throughout groups in which the antennae had 12 segments. In consequence *Xiphomyrmex* was sunk as a junior synonym of *Tetramorium*.

In the regions now under consideration *Tetramorium* is the only tetramoriine genus with endemic species, although tramp-species of the genus *Triglyphothrix* Forel are known to occur (certainly *Tr. lanuginosa* (Mayr) and very probably *Tr. kheperra* Bolton). These are distinguished from *Tetramorium* by their possession of numerous branched hairs, bifid or trifid, on all surfaces of the body. Finally, the parasitic genus *Anergates* Forel, whose host is *Tetramorium caespitum* (L.), is known from New Jersey, U.S.A., but this is hardly likely to be confused with *Tetramorium* as it lacks a worker caste, has an apterous, pupoidal male and is morphologically very distinct (see Bolton, 1976 and included references).

Species of the Malagasy region

To the present time 36 species of *Tetramorium* have been recorded from the Malagasy region, the majority of them from the island of Madagascar itself. Of these 29 are found only in Madagascar, the remaining seven species representing forms shared with the Ethiopian region only (four species), or tropical or cosmopolitan tramp-species which are also widely distributed elsewhere in the world (three species).

The *Tetramorium* fauna of the Malagasy region has never been reviewed previously and earlier literature on the subject consists only of scattered descriptions of new forms, spanning the years 1887–1926 (for endemic forms), the latter date appearing to be the last word on the subject until the present. The reasons for this are the paucity of more recent collections and the rather poor original descriptions of many of the species, so that later workers found it difficult to relate their material to the published descriptions.

The shortage of material has been rectified to a large extent by Professor W. L. Brown, whose two visits to Madagascar in 1969 and 1977, coupled with the collecting activities of A. Peyrieras, have led to a much better understanding of the fauna. This is reflected in the fact that of the 29 endemic species over half of them are described as new in the present paper.

The endemic species fall into six species-groups and it is interesting to note that in Madagascar, as in Australia, forms with 11-merous antennae greatly outnumber those in which the antennae are 12-merous. Thus, of Madagascar's 29 endemics only 4 species have 12-segmented antennae. (In Australia, of 17 known endemic species only 2 have 12-segmented antennae, and in the New World no endemic forms with 12 segments are known.) In the main range of *Tetramorium*, through the Palaearctic, Ethiopian, Oriental and Indo-Australian regions, the reverse is true: the Palaearctic has no endemic species with 11-merous antennae; the Ethiopian has 22 out of about 150 known species; the Oriental 7 out of 29 and the Indo-Australian 10 out of 46. In the first part of this study (Bolton, 1976) I speculated on the significance of this peripheral predominance of forms with 11-merous antennae and the present part seems to confirm these impressions.

Of the eight species-groups recorded from Madagascar three are peculiar to the region (*tosii*-group, *schaufussi*-group and *ranarum*-group), two are shared only with the Ethiopian region (*weitzeckeri*-group and *sericeiventre*-group) and the remainder are groups with a wide distribution (*tortuosum*-group) or which have one or more very successful tramp species (*simillimum* and *bicarinatum*-groups).

Synonymic list of species

Species shared only with Ethiopian region marked*; tramp species marked†.

- ***schaufussi*-group**
  - ***cognatum* sp. n.**
  - ***naganum* sp. n.**
  - ***proximum* sp. n.**
  - ***schaufussi*** Forel
    - *nassonowii* Forel **syn. n.**
  - ***severini*** (Emery) **comb. n.**
  - ***sikorae*** Forel
    - *latior* Santschi **syn. n.**
  - ***xanthogaster*** Santschi **stat. n.**
- ***weitzeckeri*-group**
  - ***bessoni*** Forel
    - *bessoni* var. *orientale* Forel **syn. n.**
  - ***dysalum* sp. n.**
  - ***_humbloti_** Forel
  - ***marginatum*** Forel
  - ***steinheili*** Forel
- ***tortuosum*-group**
  - ***andrei*** Forel
  - ***electrum* sp. n.**
  - ***isectum* sp. n.**
  - ***kelleri*** Forel
  - ***latreillei*** Forel
  - ***pleganon* sp. n.**
  - ***robustior*** Forel **stat. n.**
- ***ranarum*-group**
  - ***coillum* sp. n.**
  - ***degener*** Santschi
  - ***ibycterum* sp. n.**
  - ***plesiarum* sp. n.**
  - ***quasirum* sp. n.**
  - ***ranarum*** Forel
  - ***zenatum* sp. n.**
- ***tosii*-group**
  - ***tantillum* sp. n.**
  - ***tosii*** Emery
- ***bicarinatum*-group**
  - †***bicarinatum*** (Nylander)
- ***sericeiventre*-group**
  - ***_quadrispinosum_** Emery
    - *blochmanii* var. *montanum* Forel **syn. n.**
  - ***_sericeiventre_** Emery
    - *blochmannii* Forel **syn. n.**
- ***simillimum*-group**
  - ***anodontion* sp. n.**
  - †***caldarium*** (Roger) **stat. rev.**
  - ***_delagoense_** Forel **stat. n.**
    - *simillimum* var. *madecassum* Forel **syn. n.**
  - †***simillimum*** (F. Smith)
  - ***scytalum* sp. n.**

Key to species (workers)

[All species are restricted to Madagascar except where otherwise stated.]

Note. T. bessoni is keyed out in two places because of variation in pilosity. Hairs are usually present on first gastral tergite but very sparse; in a few individuals they are absent.

1 Antennae with 11 segments 2

– Antennae with 12 segments 28

2 First gastral tergite generally with pubescence (which may be very dense), but without elongate standing hairs such as are seen fringing the remaining segments, or very rarely with a sparse row on the extreme apical margin of the first tergite 3

– First gastral tergite with or without pubescence but always with elongate standing hairs such as are seen fringing the remaining segments, usually arising all over the surface of the tergite, rarely more dense basally than apically 10

3 Dorsal alitrunk mostly or entirely smooth and shining, rugular sculpture either vestigial or absent 4

– Dorsal alitrunk with conspicuous and usually coarse rugular sculpture 6

4 Mandibles smooth and shining with scattered small pits . . . . . . ***severini*** (p. 138)

– Mandibles distinctly longitudinally striate 5

5 Dorsum of head between frontal carinae coarsely longitudinally rugulose, the interspaces filled with a dense reticulate-puncturation. Clypeus with a weak median carina and numerous other meandering rugulae. (Ethiopian R.; Comoro Is.). . . . . . ***humbloti*** (p. 142)

– Dorsum of head between frontal carinae with a few weak sinuous rugulae or virtually unsculptured, the interspaces mostly shining but with some vestigial surface sculpture. Clypeus with a strong median carina flanked by a lateral pair, the spaces between without numerous meandering rugulae . . . . ***bessoni*** (part) (p. 141)

6 Mandibles coarsely longitudinally striate . . . . ***latreillei*** (p. 146)

– Mandibles either smooth with scattered pits or with feeble shagreening 7

7 With alitrunk in profile the propodeal dorsum without hairs or at most with only a single pair of short hairs arising laterad immediately behind the metanotal groove (Figs 2, 6) . . 8

– With alitrunk in profile the propodeal dorsum with numerous fine hairs which arise all over the surface (Figs 7, 26) 9

8 Larger species, HW 0·65–0·75, SL 0·50–0·60. First gastral tergite with sparse minute pubescence which is strongly appressed. Pronotal dorsum with a distinct coarse rugoreticulum ***proximum*** (p. 137)

– Smaller species, HW 0·50–0·60, SL 0·35–0·45. First gastral tergite with dense pubescence which is slightly elevated, not appressed. Pronotal dorsum with fine longitudinal rugulation ***cognatum*** (p. 135)

9 Dorsal surfaces of petiole and postpetiole in profile with fine, standing pilosity (Fig. 7) ***naganum*** (p. 136)

– Dorsal surfaces of petiole and postpetiole in profile without standing pilosity of any form (Fig. 26) . . . . ***ibycterum*** (p. 148)

10 Promesonotal dorsum completely smooth, without trace of rugular sculpture 11

– Promesonotal dorsum with distinct rugular sculpture 12

11 Promesonotum marginate laterally (Fig. 11). Erect or suberect hairs numerous and conspicuous on promesonotum, petiole, postpetiole and first gastral tergite. Mandibles smooth or at most with only faint traces of sculpture . . . . ***marginatum*** (p. 142)

– Promesonotum not marginate laterally, the dorsum rounding evenly into the sides (Fig. 9). Erect or suberect hairs inconspicuous, sparse to absent on promesonotum, petiole, postpetiole and first gastral tergite. Mandible coarsely longitudinally striate ***bessoni*** (part) (p. 141)

12 Basal one-third of first gastral tergite densely finely reticulate-punctate . ***pleganon*** (p. 146)

– Basal one-third of first gastral tergite unsculptured except for hair-pits 13

13 Metapleural lobes very reduced, scarcely visible in profile and represented by very shallow, feeble rounded flanges (Fig. 20). Propodeal spines extremely long and somewhat downcurved along their length . . . . ***electrum*** (p. 144)

– Metapleural lobes prominent, projecting in profile as triangular, dentiform or spiniform structures, rarely truncated apically. Propodeal spines variable in shape and size, but not as above (Figs 4, 13–16, 18, 19, 21, 24, 25, 27) 14

14 Mandibles smooth and shining, without any trace of longitudinal striation or rugulation . 15

– Mandibles longitudinally striate or rugulose, usually conspicuously so but only delicately marked in a few species 18

15 Head and alitrunk dark brown, the pedicel and gaster clear yellow, the two strongly contrasting ***xanthogaster*** (p. 139)

– Head, alitrunk and gaster either concolourous or with the gaster darker, but never bicoloured as above. 16

16 Promesonotum in dorsal view sharply marginate laterally (Fig. 24), almost flat transversely and sculptured with conspicuous strong, longitudinal rugae . . . . . ***dysalum*** (p. 141)

– Promesonotum in dorsal view not sharply marginate laterally, the dorsum curving into the sides and transversely convex. Sculpture of promesonotum either reticulate-rugose or irregular. 17

17 Clypeus with a median longitudinal carina. Long hairs on promesonotal dorsum sparse, restricted to a few pairs situated anteriorly and laterally. Smaller species, $SL<0{\cdot}50$. (Madagascar, Reunion I.) . . . . ***sikorae*** (p. 138)

– Clypeus without a median longitudinal carina. Long hairs on promesonotal dorsum numerous, arising all over the surface. Larger species, $SL>0{\cdot}50$ . . . . . ***schaufussi*** (p. 137)

18 Dorsum of postpetiole smooth, without trace of rugular sculpture 19

– Dorsum of postpetiole with rugular sculpture. 24

19 Antennal scrobes strongly developed; with the head in profile the scrobal area bounded above and below by strong carinae and divided into upper and lower portions by a strong median longitudinal carina (Fig. 27) . . . . ***plesiarum*** (p. 150)

– Antennal scrobes weakly or not developed, never bounded below by a strong carina nor with a median longitudinal carina dividing the scrobal area into upper and lower portions . 20

20 Node of petiole in dorsal view anteroposteriorly compressed, much broader than long; the dorsum of the node unsculptured . . . . ***steinheili*** (p. 143)

– Node of petiole in dorsal view as long as broad or slightly longer than broad; the dorsum of the node usually sculptured 21

21 Node of petiole in profile with the posterior face sloping outwards so that the posterodorsal angle overhangs the posterior face (Fig. 19). Dorsum of petiole node in profile flat ***zenatum*** (p. 151)

– Node of petiole in profile with posterior face not modified as above. Dorsum of petiole node in profile convex, if only feebly so 22

22 Rugoreticulum on pronotal dorsum distinctly raised up and sharply defined, the top surfaces of the rugulae sharp and smooth, without a beaded appearance . . . . ***degener*** (p. 148)

– Rugoreticulum on pronotal dorsum feebly raised up and blunt, the top surfaces of the rugulae bluntly rounded and with a beaded appearance due to the presence of aligned fine punctulation 23

23 Larger species with relatively slightly smaller eyes, $HW>0{\cdot}65$, $SL>0{\cdot}45$, maximum diameter of eyes about $0{\cdot}17\text{–}0{\cdot}19 \times HW$ . . . . ***ranarum*** (p. 151)

– Smaller species with relatively slightly larger eyes, $HW<0{\cdot}65$, $SL<0{\cdot}45$, maximum diameter of eyes about $0{\cdot}20\text{–}0{\cdot}21 \times HW$ . . . . ***quasirum*** (p. 150)

24 With the petiole node in profile the anterior and dorsal surfaces confluent through a convex curve or extremely obtusely rounded angle, the anterior face of the node much shorter than the posterior so that the dorsum slopes upwards posteriorly (Fig. 13). Longest hairs on hind tibiae and on scapes distinctly longer than the maximum width of the appendage from which they arise . . . . ***kelleri*** (p. 145)

– With the petiole node in profile the anterior and dorsal surfaces meeting in a sharp angle, the two not confluent (Figs 14, 16, 18, 21); anterior and posterior faces of node of approximately equal length. Longest hairs on hind tibiae and scapes much shorter than the maximum width of the appendage from which they arise 25

25 Smaller species, $HW<0{\cdot}70$, $SL<0{\cdot}50$ . . . . ***coillum*** (p. 147)

– Larger species, $HW>0{\cdot}80$, $SL>0{\cdot}60$ 26

26 Eyes very small (maximum diameter 0·14 at HW 0·92), the maximum diameter of the eye $0{\cdot}15 \times HW$ . . . . ***isectum*** (p. 145)

– Eyes larger, the maximum diameter of the eye always greater than $0{\cdot}20 \times HW$ . . . 27

27 Somewhat smaller, more slenderly built species, $HW<0{\cdot}95$ (usually $<0{\cdot}90$), with relatively longer antennal scapes, $SI>85$ . . . . ***andrei*** (p. 143)

– Somewhat larger, more stockily built species, $HW>0{\cdot}98$ (usually $>1{\cdot}00$), with relatively shorter antennal scapes, $SI<80$ . . . . ***robustior*** (p. 147)

28 Propodeum completely unarmed (Fig. 23) . . . . ***anodontion*** (p. 156)

– Propodeum armed with a pair of spines or teeth 29

29 Anterior clypeal margin with a distinct median notch or impression (Fig. 47). (Cosmopolitan tramp species) . . . . ***bicarinatum*** (p. 164)

– Anterior clypeal margin entire, without a median notch or impression 30

30 Large species, $HW>0{\cdot}70$ (usually $>0{\cdot}80$) 31

– Small to minute species, $HW<0{\cdot}60$ 34

31 Propodeal dorsum without hairs of any description (Fig. 35) 32

– Propodeal dorsum with erect or suberect fine hairs (Fig. 33) 33

32 Sculpture of dorsal alitrunk and head strong, consisting of longitudinal rugae and a dense reticulate-puncturation which blankets the entire surface. First gastral tergite usually

completely sculptured, matt and dull. (Very common in Ethiopian region) ***sericeiventre*** (p. 155)

– Sculpture of dorsal alitrunk and head feeble or absent, sometimes with a few very weak rugulae, more usually with just a superficial punctulation. First gastral tergite either unsculptured or at most with a superficial reticulation, shining. (Widespread in southern Africa) ***quadrispinosum*** (p. 155)

33 Antennal scapes both relatively and absolutely longer, SI 98, SL 0·96. Eyes very strongly prominent (Fig. 32) . . . . ***tosii*** (p. 153)

– Antennal scapes both relatively and absolutely shorter, SI<85, SL<0·80. Eyes not strongly prominent (Fig. 30) . . . . ***tantillum*** (p. 152)

34 Mandible usually smooth and shining, unsculptured except for scattered pits. If faint traces of sculpture present then petiole node in profile relatively low and broad (Fig. 29). (Aldabra, Madagascar) . . . . ***scytalum*** (p. 157)

– Mandibles sculptured and dull, either finely striate or finely shagreened, rarely with sculpture feeble in which case petiole node in profile relatively high and narrow (Fig. 28) . . 35

35 With the head in full-face view the sides immediately behind the eyes with an anteriorly directed stout, blunt hair projecting outwards at an angle of approximately 45°. (Very widespread in Ethiopian region) . . . . ***delagoense*** (p. 156)

– With the head in full-face view the sides behind the eyes without such a projecting stout hair 36

36 Frontal carinae strongly developed throughout their length, sinuate, running unbroken almost to the occipital margin and surmounted throughout their length by a narrow raised rim or flange. The whole of the frontal carinae much more strongly developed than the remaining cephalic rugulae. Ground sculpture of head between frontal carinae strongly granular or reticulate-punctulate, the surfaces matt. Antennal scrobes shallow but broad and conspicuous (Fig. 41). (Cosmopolitan tramp species) . . . . . ***simillimum*** (p. 170)

– Frontal carinae feebly developed, weakly or not sinuate, most strongly developed to level of midlength of eye behind which they become very weak or broken, or gradually fade out posteriorly; not surmounted by a raised rim or flange beyond the level of the midlength of the eye, behind which the carinae are no stronger than the remaining cephalic rugulae. Ground sculpture of head more feeble than above, the surfaces dully shining. Antennal scrobes vestigial (Fig. 42). (Tramp species mostly in tropics and subtropics) ***caldarium*** (p. 169)

The *schaufussi*-group

Antennae with 11 segments, sting appendage spatulate. Mandibles smooth and highly polished, unsculptured except for scattered pits. Clypeus with a median notch or impression in the anterior margin. Petiole nodiform, without sharp angles, all sides of the node rounding into the dorsum through curves or very blunted angles, not separated by acute angles or edges. Postpetiole low nodiform, rounded dorsally. Both segments of pedicel unsculptured, smooth and shining.

This small group of seven species is restricted to the Malagasy region, but its closest relatives appear to belong to the *grassii*-group of South Africa, despite the fact that the antennae have 12 segments in that group.

Within the Malagasy region the species of the *schaufussi*-group fall neatly into two complexes of related forms. The first of these, containing the species *cognatum*, *naganum*, *proximum* and *severini*, is characterized by a complete lack of pilosity on the first gastral tergite and generally also by a reduction in pilosity on the pedicel segments and propodeum (not in *naganum*). These species are discussed under *cognatum*. The second group includes *schaufussi*, *sikorae* and *xanthogaster*, in which pilosity is distributed all over the first gastral tergite (in a few individuals the pilosity may be more dense basally than apically), and these forms are discussed under *schaufussi*.

Tetramorium cognatum sp. n.
(Figs 1, 2)

HOLOTYPE WORKER. TL 2·8, HL 0·66, HW 0·56, CI 85, SL 0·42, SI 75, PW 0·44, AL 0·78.

Mandibles smooth, with scattered small pits. Anterior margin of clypeus with a shallow median impression, the clypeus with a pair of lateral carinae which are at least as strongly developed as the median. Frontal carinae extended back on head by a pair of weak ridges which are almost parallel, very slightly sinuate. Antennal scrobes feeble, scarcely impressed but as long as the scapes, the latter short. Corners of pronotum in dorsal view angular. Metanotal groove feebly impressed with the alitrunk in profile. Propodeum armed with a pair of short triangular spines, the metapleural lobes triangular and larger than the propodeal spines (in some specimens the two are subequal). Node of petiole high and narrow, rounded, in dorsal view slightly broader than long. Dorsum of head and promesonotum finely longitudinally rugulose, the rugulae irregular and tending to meander slightly, the spaces between the rugulae with a fine superficial sculpture of small punctures. Pedicel and gaster unsculptured. Dorsum of head and alitrunk with sparse pubescence and with a number of long, erect hairs (variable on propodeum, usually hairless but some with a single short pair laterad, immediately behind the metanotal groove). First gastral tergite with long and quite dense pubescence but without long hairs such as are seen on the head, alitrunk, and fringing the remaining gastral tergites. Colour mid-brown, the gaster slightly darker.

PARATYPE WORKERS. As holotype but some more lightly and others more darkly coloured. The petiole node shows some variation and may be as broad as long in dorsal view. The range of dimensions noted is TL 2·5–2·8, HL 0·60–0·66, HW 0·54–0·58, CI 85–91, SL 0·36–0·42, SI 70–75, PW 0·40–0·44, AL 0·70–0·78 (10 measured).

Holotype worker, **Madagascar**: Périnet & vic., rain for. rot. wd., 19.iii.1969, rain forest (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 11 workers with same data as holotype; 5 workers and 2 females with same data as holotype but 17.iii.1969; 2 workers with same data as holotype but 18.iii.1969 (MCZ, Cambridge; BMNH; MHN, Geneva; NM, Basle).

In the *schaufussi*-group the *cognatum*-complex of species is characterized by the lack of pilosity on the first gastral tergite but its retention on succeeding segments. In this complex are *severini*, *proximum*, *cognatum* and *naganum*. Of these *severini* is the most conspicuous, being larger than the rest (compare measurements) and having very reduced sculpture on the dorsal alitrunk. The other three species are distinctly smaller and the dorsal alitrunk is strongly rugulose or reticulate-rugulose. *T. naganum* is distinguished by having numerous fine hairs on propodeum and pedicel segments which are absent in the other three members of this complex, although a single pair of fine short hairs is developed laterad immediately behind the metanotal groove in some samples of *cognatum*. Finally, *cognatum* is separated from *proximum* by the presence in the latter of dense short pubescence on the first gastral tergite which is slightly elevated, whilst in the former pubescence is minute, very sparse and strongly appressed.

It is interesting to note that *ibycterum* of the *ranarum*-group and *latreillei* of the *tortuosum*-group have paralleled the members of this complex in losing the pilosity of the first gastral tergite, though what advantage is gained by suppressing the gastral hairs cannot be guessed at.

NON-PARATYPIC MATERIAL

Madagascar: no loc. (*Staudinger*); vic. Andasibé (=Périnet) (*W. L. & D. E. Brown*); Parc. Nat. Mont. d'Ambre (*W. L. & D. E. Brown*); La Mandraka (*W. L. & D. E. Brown*).

Tetramorium naganum sp. n.

(Fig. 7)

HOLOTYPE WORKER. TL 2·8, HL 0·70, HW 0·66, CI 94, SL 0·48, SI 73, PW 0·48, AL 0·78.

Mandibles smooth with scattered pits, without longitudinal striation. Anterior clypeal margin with a median notch or impression. Frontal carinae moderately well developed, extending back almost to the occiput, but becoming confused with the remaining cephalic sculpture before reaching it. Antennal scrobes broad and shallow, without delimited ventral or posterior margins. In full-face view the occipital margin broadly concave, the sides of the head evenly convex and the head narrower in front of the eyes than behind. Dorsal alitrunk in profile evenly convex, the propodeum armed with a pair of straight narrow spines. Metapleural lobes triangular and acute. Node of petiole high and narrow, shaped as in Fig. 7; in dorsal view subglobular, very slightly broader than long. Dorsum of head irregularly longitudinally rugulose, the rugulae fine and widely separated and the interspaces with distinct granular or punctulate ground-sculpture. Dorsal alitrunk covered with irregular fine rugulae which form a disorganized and very broken reticulum, the spaces between them with feeble ground-sculpture which is weaker than on the head. Petiole, postpetiole and gaster unsculptured. Dorsal surfaces of head, alitrunk, petiole and postpetiole with numerous erect fine long hairs and also with scattered pubescence, also erect or suberect. First gastral tergite with abundant subdecumbent pubescence, but without long hairs such as are obvious on the dorsal alitrunk and fringing the remaining gastral segments. Colour orange-brown.

PARATYPE WORKERS. TL 2·8–2·9, HL 0·68–0·70, HW 0·62–0·66, CI 90–94, SL 0·46–0·50, SI 73–78, PW 0·47–0·50, AL 0·70–0·78 (11 measured). As holotype.

Holotype worker, **Madagascar**: La Mandraka, 1280 m, 8.ii.1977, leaf litter, mont. forest, AB 41 nest in seed capsule in litter (*W. L. & D. E. Brown*) (MCZ, Cambridge).

Paratypes. 16 workers and 1 dealate female, with same data as holotype (MCZ, Cambridge; BMNH).

Among the species of the *schaufussi*-group which lack long hairs on the first gastral tergite, *naganum* is unique in having fine long hairs present on the propodeum, petiole and postpetiole. As in *cognatum*, pubescence on the first gastral tergite is dense and somewhat elevated, not minute, scattered and appressed as in *proximum*.

Tetramorium proximum sp. n.

(Figs 5, 6)

HOLOTYPE WORKER. TL 3·5, HL 0·82, HW 0·72, CI 88, SL 0·58, SI 80, PW 0·56, AL 1·02.

Mandibles smooth with scattered small pits. Clypeus with a distinct median notch or impression and developed median carina. Frontal carinae strong, extending back well behind the posterior margins of the eyes, the two carinae nearly parallel, only slightly divergent posteriorly. Scrobes shallow but well differentiated, capable of containing the scape. Pronotal corners angulate in dorsal view. Metanotal groove a broad, shallow impression; propodeal spines quite short, stout and acute, the metapleural lobes broadly triangular, almost but not quite as long as the propodeal spines. Node of petiole in profile high, narrow, the anterior and posterior faces more or less parallel, the dorsum convex (Fig. 6). In dorsal view the outline of the node almost circular, only a very little broader than long. Dorsum of head longitudinally rugose, the dorsal alitrunk with a strong rugoreticulum. Pedicel and gaster unsculptured, completely smooth, shining. Dorsum of head and promesonotum with a number of erect to suberect fine long hairs, the propodeum, pedicel and first gastral tergite without hairs but the last with sparse fine, very short, appressed pubescence. Remaining gastral tergites with long hairs as on promesonotum. Colour light brown, shiny.

PARATYPE WORKERS. As holotype but varying in colour from light to quite dark brown, the most deeply coloured specimens with a reddish tinge on the alitrunk. Dimensions in range TL 3·2–3·5, HL 0·76–0·82, HW 0·64–0·70, CI 82–89, SL 0·54–0·58, SI 80–85, PW 0·48–0·56, AL 0·92–1·00 (10 measured).

Holotype worker, **Madagascar**: Périnet & vic., rain for. rot. wd., 18.iii.1969 (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 10 workers and 1 female, same data as holotype (MCZ, Cambridge; BMNH).

This is one of the four species constituting the *cognatum* complex within the *schaufussi*-group, and as such lacks pilosity on the first gastral tergite. The separation of *proximum* is dealt with under the discussion of *cognatum*, but it can be noted here that good diagnostic characters of *proximum* within its species-group include absence of pilosity on propodeum, pedicel and first tergite coupled with a distinct rugoreticulum on the promesonotum and very dilute short gastral pubescence which is appressed.

NON-PARATYPIC MATERIAL

Madagascar: no loc. (*Staudinger*); 2 specimens without data in Forel Coll. (MHN, Geneva); Parc Nat. Mont. d'Ambre (*W. L. & D. E. Brown*); vic. Andasibé (=Périnet) (*W. L. & D. E. Brown*).

Tetramorium schaufussi Forel

Tetramorium (*Xiphomyrmex*) *schaufussi* Forel, 1891*a* : 158. Holotype worker, MADAGASCAR: central province (*C. Schaufuss*) (MHN, Geneva) [examined].

Tetramorium (*Xiphomyrmex*) *nassonowii* Forel, 1892: 521. Syntype workers, MADAGASCAR: Forêt d'Andrangoloaka (*Sikora*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. TL 3·3–4·0, HL 0·78–0·98, HW 0·70–0·86, CI 87–90, SL 0·54–0·64, SI 73–77, PW 0·52–0·66, AL 0·98–1·10 (7 measured).

Mandibles smooth with scattered small pits. Median clypeal carina poorly developed or absent. If the former then the carina is no stronger than the remaining clypeal sculpture and cannot be distinguished from it. Frontal carinae extended back behind level of eyes but only weakly developed, the scrobes broad, shallow and poorly defined. Propodeal spines short, triangular, usually shorter than the broadly triangular metapleural lobes, more rarely about as long as the lobes. Head with fine longitudinal rugulae dorsally, the dorsal alitrunk predominantly longitudinally rugose but with some reticulation usually on the anterior pronotum and the propodeum. Pedicel and gaster unsculptured, smooth and shining. All dorsal surfaces of head and body with numerous fine hairs, erect to suberect.

T. schaufussi and *sikorae* form a close species-pair within the *schaufussi*-group and in general have a very similar appearance. They both belong to the *sikorae*-complex of species, characterized by the presence of hairs on the first gastral tergite, and this complex also includes *xanthogaster* which is easily separated (see under *sikorae*). *T. sikorae* and *schaufussi* are best separated by their pilosity as on the dorsal promesonotum pilosity in *sikorae* is sparse, restricted to some 2–3 pairs (rarely 4) situated on the margins anteriorly and laterally, whereas in *schaufussi* the promesonotum has numerous hairs which arise all over the surface.

MATERIAL EXAMINED

Madagascar: no loc. (*Staudinger*); no. loc (*Sikora*).

Tetramorium severini (Emery) **comb. n.**

(Fig. 8)

Xiphomyrmex severini Emery, 1895*b* : 343. Syntype workers, MADAGASCAR: Diego-Suarez, 1893 (*C. Alluaud*) (MCSN, Genoa; MHN, Geneva) [examined].

WORKER. TL 4·5, HL 1·06, HW 0·94, CI 89, SL 0·76, SI 81, PW 0·72, AL 1·30.

Mandibles smooth with scattered small pits. Anterior clypeal margin with a distinct median indentation, the median clypeal carina strongly developed. Frontal carinae long and strong, the extensions forming the upper border of the scrobe which is capable of holding the scape. Metanotal groove distinct with alitrunk in profile. Propodeal spines long and acute, the metapleural lobes low and rounded. Dorsum of head with spaced-out longitudinal rugae which tend to peter out as they approach the occipital margin, the spaces between the rugae with some fine, superficial puncturation. Dorsal alitrunk mostly unsculptured and shining, with scattered, very faint, low rugulae which are almost completely effaced. Pedicel and gaster unsculptured, smooth and shining. Dorsal surfaces of head and alitrunk with scattered fine, elongate hairs, which are also present on the gastral tergites behind the first; pedicel and first gastral tergite without hairs. Colour black or blackish brown, uniform or with the gaster slightly lighter in shade than the alitrunk.

In his original description Emery was of the opinion that this species was related to *andrei* and *latreillei* but this has proved not to be the case as in both those species the mandibles are striate and the petiole nodes angular and sculptured, whereas in *severini* the mandibles are smooth and the petiole node is rounded and unsculptured, showing that the true affinities of *severini* lie with the members of the *schaufussi*-group and particularly with the small complex of species related to *cognatum* in which gastral pilosity is lost from the first tergite. The four species included in this complex are discussed under *cognatum*.

Tetramorium sikorae Forel

Tetramorium (*Xiphomyrmex*) *sikorae* Forel, 1892 : 522. Syntype workers, MADAGASCAR: Amparafaravantsiv (*Sikora*) (MHN, Geneva) [examined].

Xiphomyrmex latior Santschi, 1926 : 243. Syntype workers, MADAGASCAR: Fananantsoa [=Fianorantsoa on data label] (*Descarpentries*) (NM, Basle) [examined]. **Syn. n.**

WORKER. TL 2·7–3·2, HL 0·64–0·70, HW 0·54–0·60, CI 84–91, SL 0·40–0·46, SI 71–80, PW 0·42–0·48, AL 0·74–0·88 (5 measured).

Mandibles smooth with scattered small pits, median clypeal carina distinct. Frontal carinae extended back well beyond the level of the eyes, almost parallel and forming the upper margins of a shallow scrobe which is capable of accommodating the scape. With the alitrunk in profile the metanotal groove shallowly impressed. Propodeum armed with a pair of short, triangular teeth which are shorter than the broadly triangular metapleural lobes. Dorsum of head with very fine longitudinal rugulae and a distinct interrugal sculpture of fine but conspicuous superficial puncturation. Dorsal alitrunk finely rugulose, the pedicel and gaster unsculptured, smooth and shining. Erect or suberect long, fine hairs present on all dorsal surfaces of the body but may be absent from the pedicel segments. Colour yellow-brown.

A small and quite distinctive species, *sikorae* has nevertheless been confused with the *cognatum* complex in the past. The best character for separating them lies in the fact that *sikorae* has numerous erect or suberect hairs on the first gastral tergite; such hairs being absent in *cognatum* and its allies.

Within the *schaufussi*-group, *sikorae* forms the central species of what may be loosely termed the *sikorae*-complex, including the close pair of *sikorae* and *schaufussi*, and the rather more distantly related *xanthogaster*, all of them possessing, within the *schaufussi*-group, hairs on the first gastral tergite. In *xanthogaster* the frontal carinae are feeble, scrobes are absent and the propodeal spines are quite long, besides which the species is bicoloured. The two remaining species are best separated by the characters given under *schaufussi*.

MATERIAL EXAMINED

Madagascar: vic. Andasibé (=Périnet) (*W. L. & D. E. Brown*). **Reunion I.** (ex coll. Mayr).

Tetramorium xanthogaster Santschi **stat. n.**

(Figs 3, 4)

Tetramorium (*Xyphomyrmex*) [sic] *sikorae* st. *xantogaster* [sic] Santschi, 1911: 124. Holotype worker, MADAGASCAR (*J. de Gaulle*) (NM, Basle) [examined].

Xiphomyrmex sikorae subsp. *xanthogaster* Santschi; Wheeler, 1922: 1032. Emery, 1922: 287 [justified emendation].

WORKER. TL 3·2, HL 0·76, HW 0·66, CI 89, SL 0·54, SI 82, PW 0·50, AL 0·88.

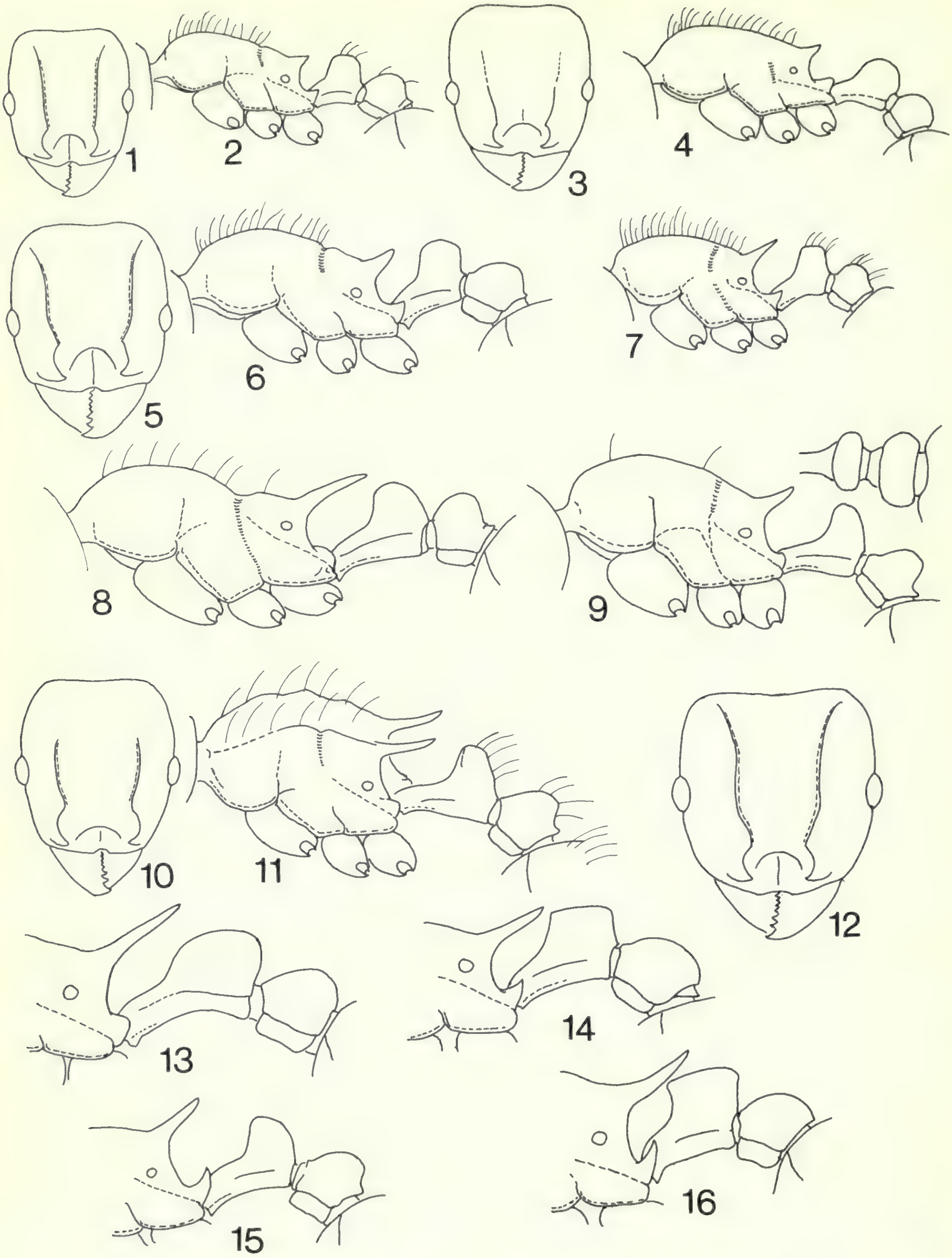
Mandibles smooth with scattered small pits. Median clypeal carina very faint, almost effaced, much less distinct than the lateral carinae. Frontal carinae very reduced, their posterior extensions fine and no more distinct than the rugulae between them. Antennal scrobes absent. Metanotal groove not impressed. Propodeum armed with a pair of short, stout spines, the metapleural lobes roughly triangular. Dorsum of head with very fine, faint, irregular longitudinal rugulae and with a superficial reticulate ground sculpture between them. Dorsal alitrunk with scattered, weak, predominantly longitudinal rugulae. Pedicel and gaster unsculptured, smooth and polished. All dorsal surfaces of head and body with erect or suberect fine hairs. Head and alitrunk dark brown, pedicel and gaster clear pale yellow, the two strongly contrasting.

As Santschi pointed out in the original description, this small species is close to *sikorae*, but unlike that species it is bicoloured, has relatively longer antennal scapes, lacks scrobes and has much better developed propodeal spines. The presence of gastral pilosity places this species in the *sikorae*-complex of the *schaufussi*-group, but the characters given above will quickly separate *xanthogaster* from its allies.

The *weitzeckeri*-group

Antennae with 11 segments, the sting appendage spatulate. Mandibular sculpture varying from strongly longitudinally striate to absolutely smooth. Nodes of petiole and postpetiole unsculptured, at least the petiole tending to be anteroposteriorly compressed, strongly squamiform in some species. More rarely the postpetiole also squamiform.

The *weitzeckeri*-group is the commonest group of species with 11-merous antennae in the Ethiopian region, where about 13 species are present. Four endemic species of this group are known from Madagascar and an African species, *humbloti*, is known from the Comoro Islands but has



Figs 1–16 *Tetramorium* workers. 1–12. Head and/or alitrunk of (1, 2) *cognatum*, (3, 4) *xanthogaster*, (5, 6) *proximum*, (7) *naganum*, (8) *severini*, (9) *bessoni*, (10, 11) *marginatum*, (12) *steinheili*. 13–16. Petiole and postpetiole of (13) *kelleri*, (14) *andrei*, (15) *steinheili*, (16) *robustior*. Pilosity omitted from heads and from Figs 13 to 16.

not yet been recorded from Madagascar proper. These five species fall into two close species-pairs and a solitary, less easily accounted for species. The first pair, *bessoni* and *humbloti*, have the alitrunk rounded transversely above, with very reduced pilosity and sculpture. The second pair, *dysalum* and *marginatum*, have the alitrunk flat transversely above and the sides strongly marginate. The final species, *steinheili*, is a much larger and more robust form which in many respects approaches the *tortuosum*-group.

Tetramorium bessoni Forel

(Fig. 9)

Tetramorium (*Xiphomyrmex*) *bessonii* Forel, 1891*a*: 156, pl. 4, figs 13, 13a. Syntype workers, MADAGASCAR: Pays des Betsileo, Fianarantsoa (*Besson*) (MHN, Geneva) [examined].

Tetramorium (*Xiphomyrmex*) *bessonii* var. *orientale* Forel, 1895*a*: 247. Holotype worker, MADAGASCAR: Imerina oriental (*Sikora*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. TL 4·0–4·2, HL 0·88–0·90, HW 0·82–0·86, CI 90–95, SL 0·60–0·70, SI 74–80, PW 0·62–0·66, AL 1·08–1·14 (6 measured).

Mandibles striate, median clypeal and cephalic carinae well defined and distinct. Frontal carinae strongly developed but antennal scrobes weak. Propodeum armed with a pair of stout spines, the metapleural lobes low and rounded. In profile the petiole strongly antero-posteriorly compressed, thick-squamiform, the node much higher than long. Postpetiole also somewhat compressed. In dorsal view both petiole and postpetiole much broader than long. Clypeus with median and one or two pairs of lateral carinae, the spaces between them feebly or not sculptured. Dorsum of head with median carina and a few widely spaced, weak longitudinal rugulae on each side between median and frontal carinae. These rugulae variable, may be almost completely effaced to quite distinct. Ground-sculpture between the rugulae a very weak, superficial punctulation, again nearly effaced in some individuals. Dorsal alitrunk, pedicel and gaster unsculptured or at most with a few very faint rugulae in the vicinity of the metanotal groove. Erect to suberect hairs present on all dorsal surfaces of head and body but very sparse or (rarely) absent from the first gastral tergite. Colour a uniform medium-brown.

This species is closest related to *humbloti*, an African species which is known to occur on the Comoro Islands but has not yet been reported from Madagascar itself. The two are separated by sculpture, which on the head of *humbloti* is coarse and by the presence in *bessoni* of a number of erect or suberect hairs on the dorsal alitrunk, which is usually completely hairless in *humbloti*.

MATERIAL EXAMINED

Madagascar: La Mandraka (*W. L. & D. E. Brown*); Prov. Diego S., above Sakaramy (*W. L. & D. E. Brown*).

***Tetramorium dysalum* sp. n.**

(Fig. 24)

HOLOTYPE WORKER. TL 3·1, HL 0·72, HW 0·71, CI 99, SL 0·50, SI 70, PW 0·52, AL 0·84.

Mandibles smooth and shining, unsculptured except for minute pits. Anterior clypeal margin with an impression or notch. Frontal carinae strong, surmounted by a narrow raised rim or flange. Alitrunk sharply marginate anteriorly and laterally, the margination of the sides interrupted at the promesonotal junction and more strongly impressed at the metanotal area, between mesonotum and propodeum. Pronotal dorsum transversely flat, the propodeal dorsum transversely feebly concave. Propodeum with a pair of long, acute spines which are slightly downcurved along their length. Metapleural lobes triangular. Node of petiole in profile high and quite narrow, the anterodorsal angle somewhat higher than the posterodorsal so that the slightly convex dorsal surface slopes downwards posteriorly. Dorsum of head regularly longitudinally rugulose, the interspaces with very feeble superficial ground-sculpture. Dorsal alitrunk strongly longitudinally rugose. Petiole and gaster unsculptured but dorsum of postpetiole with very faint traces of superficial sculpture. All dorsal surfaces of head and body with numerous elongate, fine hairs. Colour uniform brown.

PARATYPE WORKERS. TL 2·7–3·1, HL 0·64–0·72, HW 0·60–0·71, CI 95–100, SL 0·43–0·50, SI 68–73, PW 0·46–0·52, AL 0·74–0·84 (15 measured).

As holotype but some specimens slightly darker in shade than the holotype, often the gaster lighter in shade than the alitrunk. The entire type-series apparently represents a single nest-sample, so the normal size variation in this species is fairly large. The degree of curvature of the propodeal spines varies, most specimens being as holotype but a few have them slightly more or slightly less downcurved.

Holotype worker, **Madagascar**: Périnet & vic., rain forest, 17.iii.1969 (*W. L. Brown*) (MCZ, Cambridge).
Paratypes. 39 workers and 1 dealate queen with same data as holotype but on some pins the lower label having 'rot. wood' or 'for. litter' (MCZ, Cambridge; BMNH).

NON-PARATYPIC MATERIAL.
Two series collected more recently by W. L. Brown in **Madagascar**: vic. Andasibé (= Périnet), 2–6.ii.77, and **Mangabé I.**: Antongil Bay, 19.ii.77, agree well with the above description but in the Andasibé series body hairs are darker in colour than in the type-series.

This species appears to be close to *marginatum*, but in that species the dorsal alitrunk is unsculptured.

Tetramorium humbloti Forel

Tetramorium (*Xiphomyrmex*) *humbloti* Forel, 1891*a* : 154, pl. 4, fig. 12. Syntype workers, COMORO Is.: Grand Comoro I., Ngasiya (*L. Humblot*) (MHN, Geneva) [examined].

WORKER. TL 3·4–4·1, HL 0·80–0·94, HW 0·74–0·88, CI 92–95, SL 0·56–0·72, SI 74–84, PW 0·54–0·66, AL 0·88–1·08 (30 measured).

Mandibles finely longitudinally striate. Antennal scrobes represented by an impressed area bounded above by the frontal carinae but without a differentiated ventral margin. Alitrunk in profile with the propodeum sloping downwards strongly from the metanotal groove to the base of the stout, acute spines. Metapleural lobes acutely triangular and generally slightly upcurved. Both petiole and postpetiole strongly anteroposteriorly compressed, in profile narrow and much higher than the dorsum is long, in dorsal view markedly transverse, much broader than long, in general form similar to that of *bessoni*, Fig. 9. Head strongly longitudinally rugulose, often with cross-meshes and always with the spaces between the rugulae reticulate-punctate. Dorsal alitrunk unsculptured or at most with some weak punctulation on the pro- or mesonotum. Pedicel segments and gaster unsculptured. Head with sparse, fine, erect hairs. Alitrunk and pedicel usually without hairs but rarely with 2–6 hairs present on the former. First gastral tergite always without hairs, but remaining tergites with them. Colour varying from light to dark brown, the gaster sometimes darker in shade than the alitrunk.

T. humbloti is an African species which has extended its range to include the Comoro Islands, but has not yet been discovered on the mainland of Madagascar. In Madagascar is a sibling of *humbloti*, *T. bessoni*, which has the head consistently less strongly sculptured and also tends to be more densely hairy than *humbloti*. Details for their separation are noted in the key.

As noted above, *humbloti* really belongs to the Ethiopian region fauna, and the description is based mainly upon such material. Discussion of the synonymy and distribution of *humbloti* is not given here as it will be dealt with in the part of this study dealing with the Ethiopian region.

Tetramorium marginatum Forel

(Figs 10, 11)

Tetramorium (*Xiphomyrmex*) *marginatum* Forel, 1895*b* : 485. Syntype workers, MADAGASCAR: central Madagascar (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 3·8–3·9, HL 0·84–0·86, HW 0·78, CI 90–93, SL 0·68–0·70, SI 87–90, PW 0·60, AL 1·00–1·02 (2 measured).

Mandible with a few faint and feeble striae but with extensive smooth areas. Clypeus with a sharp, fine median carina. Frontal carinae short, ending just posterior to the level of the eyes. Antennal scrobes very weak, merely short, shallow impressions below the frontal carinae and not as long as the antennal scapes. Pronotal corners rounded in dorsal view, the sides of the pronotum bluntly marginate. Dorsum of mesonotum and propodeum separated from the sides by an acute, very distinct margination which runs to the bases of the long, acute propodeal spines. Dorsal alitrunk between the margination transversely flat, longitudinally feebly convex. Metapleural lobes short and rounded. Petiole in profile anteroposteriorly compressed, the node tapering from base to apex as shown in Fig. 11. Dorsum of head with sparse, scattered, fine longitudinal rugulae which peter out posteriorly. Dorsal alitrunk unsculptured but with superficial patterning, the pedicel and gaster unsculptured. All dorsal surfaces of head and body with erect or suberect fine hairs. Head and alitrunk black or blackish brown, the pedicel and gaster dark brown.

Rendered highly conspicuous among the Malagasy tetramoriines by its lack of sculpture, sharply margined mesonotum and propodeum and compressed petiole, *marginatum* is unlikely to be confused with any other member of the genus from Madagascar or Africa.

MATERIAL EXAMINED
Madagascar: Rte d'Anosibé (*W. L. & D. E. Brown*); Beforona (*A. Peyrieras*).

Tetramorium steinheili Forel

(Figs 12, 15)

Tetramorium (*Xiphomyrmex*) *steinheili* Forel, 1892 : 520. Syntype workers, females, MADAGASCAR: Forêt d'Andrangoloaka, confins de l'Imerina (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 4·3–4·4, HL 1·00, HW 0·94–0·96, CI 94–96, SL 0·72–0·76, SI 77–80, PW 0·68–0·72, AL 1·18–1·20 (2 measured).

Mandibles striate; median clypeal carina sharp. Extensions of frontal carinae long and strong, slightly sinuate from origin to behind the level of the eyes and then strongly divergent, directed towards the occipital corners. Pronotum and mesonotum obtusely marginate at the sides, in dorsal view separated by an impression. Metanotal groove absent, not impressed in profile. Propodeal spines long and stout, metapleural lobes elongate-triangular, acute or blunted apically. Petiole node anteroposteriorly compressed, in dorsal view much broader than long. Dorsum of head regularly longitudinally rugulose, the alitrunk more coarsely rugose, predominantly longitudinal but the rugae meandering and with a few cross-meshes present. Pedicel and gaster unsculptured, smooth and shining. All dorsal surfaces of head and body with numerous fine, erect to suberect hairs. Leading (anterior) edges of antennal scapes with short, projecting, suberect to subdecumbent hairs which are shorter than the maximum width of the scape. Colour reddish brown, the gaster paler than the alitrunk.

In overall appearance *steinheili* resembles some of the members of the *tortuosum*-group, but the unsculptured pedicel segments and the fact that the petiole is distinctly anteroposteriorly compressed seem to indicate that the affinities of *steinheili* are with *humbloti* and its relatives. Despite this I feel that there is a distinct possibility that this species may truly be related to *andrei* and its allies, and convergent upon the *weitzeckeri*-group in pedicel structure.

MATERIAL EXAMINED
Madagascar: Andranobé, Route d'Andriamena (*A. Peyrieras*); Bemanevika, Souspref. Bealanana (*A. Peyrieras*).

The *tortuosum*-group

Antennae with 11 segments, the sting appendage spatulate. Petiole nodiform; one or both pedicel segments with rugose or rugulose sculpture in all Malagasy and New World species. Mandibles sculptured. Large species usually with HW$>$0·80, rarely less. Legs usually with dense or fairly dense pilosity which is suberect to subdecumbent on the dorsal (outer) surfaces of the middle and hind tibiae.

Within the genus *Tetramorium* this is the largest species-group with 11-merous antennae. The group is represented by about 25 species in the Old World tropics and subtropics, and 7 of these species occur only in Madagascar.

Tetramorium andrei Forel

(Fig. 14)

Tetramorium (*Xiphomyrmex*) *andrei* Forel, 1891*b* : 263. Syntype workers, MADAGASCAR: Bezanozano nr Nosibé, ESE. of Antananarivo (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 4·3–4·8, HL 1·04–1·08, HW 0·92–0·96, CI 87–90, SL 0·80–0·84, SI 86–89, PW 0·70–0·72, AL 1·30–1·34 (6 measured).

Mandibles striate; median clypeal carina acute. Frontal carinae long and strong, diverging towards the occipital corners behind the level of the eyes but merging into the sculpture before reaching the occipital margin. Antennal scrobes a groove capable of containing the scape. Metanotal groove absent, not impressed in profile. Propodeal spines long and acute, the metapleural lobes short and triangular. Petiole node in profile longer than high, flat-topped or feebly convex dorsally, in dorsal view as long as or longer than broad. Dorsum of head regularly longitudinally rugose; dorsal alitrunk similarly sculptured but with some reticulation towards the sides on the pronotum. Petiole and postpetiole with rugose sculpture which is predominantly longitudinal. Gaster unsculptured except for pits from which hairs arise; these are more conspicuous in some specimens than in others. Dorsal surfaces of head and body all with numerous long, fine, erect to suberect hairs. Leading edges of antennal scape with suberect short, curved hairs. Colour light red-brown.

Of the *tortuosum*-group species on Madagascar *andrei* is most closely related to *robustior*, originally described as an infraspecific variant of *andrei*, and rather more distantly to *latreillei* and *kelleri*. Differences from *robustior* are listed under that species. *T. andrei* is distinguished easily from *latreillei* as the latter lacks hairs on the first gastral tergite and does not have standing hairs on the antennal scapes. *T. kelleri*, on the other hand, has abundant long hairs, the longest on the scapes being much greater than the maximum scapal width. Also, the node shape of the petiole is radically different, compare Figs 13 and 14.

MATERIAL EXAMINED

Madagascar: no loc. (*Staudinger*); no loc. (ex coll. Mayr); Ampasimbé, prov. Tamatave (*J. M. Betsch*).

Tetramorium electrum sp. n.

(Fig. 20)

HOLOTYPE WORKER. TL 4·9, HL 1·14, HW 1·06, CI 93, SL 0·82, SI 77, PW 0·76, AL 1·32.

Mandibles longitudinally striate but only shallowly so, the sculpture reduced in some paratypes. Clypeal margin with a median notch or impression. Frontal carinae long and strong, reaching back almost to the occipital corners and surmounted by a narrow raised rim or flange. Antennal scrobes shallow but broad, the scrobal area above the eye traversed by about four widely spaced longitudinal rugulae, the space for accommodation of the scape unsculptured. Maximum diameter of eye about 0·20. Pronotal dorsum in dorsolateral view feebly transversely concave, the remainder of the dorsum more or less flat transversely and marginate laterally so that sides and dorsum meet in a sharp angle. Propodeal spines very long, in profile downcurved along their length. Metapleural lobes reduced to low, rounded vestiges (Fig. 20), not at all triangular and scarcely prominent in profile. Petiole with a long peduncle and relatively high node (Fig. 20), in dorsal view very slightly longer than broad. Dorsum of head with spaced-out longitudinal rugulae, many of which are discontinuous and which do not form a reticulum occipitally. Spaces between rugulae with slight, very faint ground-sculpture, extensively shining. Dorsal alitrunk centrally with a series of parallel, strong longitudinal rugae which run from anterior pronotum to propodeum. Outside of these are a few disorganized longitudinal rugae and close to the margins there is a tendency for a rugoreticulum to form. Dorsal surfaces of both petiole and postpetiole with faint traces of weak rugulation, which is stronger on the sides; gaster unsculptured. All dorsal surfaces of head and body with numerous fine, acute hairs. Colour dark brown.

PARATYPE WORKERS. TL 4·7–5·2, HL 1·04–1·20, HW 0·96–1·16, CI 92–96, SL 0·74–0·86, SI 72–78, PW 0·72–0·82, AL 1·24–1·40 (11 measured). Maximum diameter of eye *c.* 0·20 (about 0·17–0·19 × HW). As holotype but some specimens darker in colour, blackish brown, and a few with the mandibular sculpture reduced and quite faint.

Holotype worker, **Madagascar**: Rte d'Anosibé, km33, 4–12.iv.1975 forest humus and litter, AB 44 (*A. Peyrieras*) (MCZ, Cambridge).

Paratypes. **Madagascar**: 11 workers with same data as holotype (MCZ, Cambridge; BMNH); one worker, vic. Andasibé (=Périnet) 950–980 m, 2–6.ii.1977 (*W. L. & D. E. Brown*) (MCZ, Cambridge).

The exceptionally long, downcurved propodeal spines, reduced metapleural lobes and large size will differentiate *electrum* from all members of its group. The only other species of the group in which the metapleural lobes are reduced is *kelleri*, but here they are still prominent and the node is very differently constructed (compare Figs 13 and 20).

Tetramorium isectum sp. n.

(Figs 17, 18)

HOLOTYPE WORKER. TL 4·1, HL 0·96, HW 0·92, CI 96, SL 0·72, SI 78, PW 0·68, AL 1·12.

Mandibles strongly longitudinally striate, anterior clypeal margin with a distinct median impression. Eyes small, maximum diameter 0·14, about 0·15 × HW. Frontal carinae long and strong, running back to the occipital corner in full-face view and surmounted throughout their length by a narrow raised rim or flange. Antennal scrobes shallow and feeble, the sides of the head above the eye regularly longitudinally rugulose. Occipital margin of head markedly concave in full-face view, the sides shallowly but evenly convex. Pronotal dorsum transversely concave, the mesonotum and propodeum more or less flat. Anterior pronotal angles rounded in dorsal view. Propodeal spines elongate and narrow, elevated and feebly upcurved along their length. Metapleural lobes elongate triangular and acute. Shape of petiole as in Fig. 18, in dorsal view longer than broad and broader behind than in front. Clypeus with three longitudinal carinae. Dorsum of head strongly and regularly longitudinally rugose, the spaces between them with very faint superficial punctulation and with about 8 strong rugae between the frontal carinae at eye-level. Cross-meshes or anastomoses absent except laterally on the occiput. Dorsal alitrunk with very strongly raised longitudinal rugae, the five central ones of which run from pronotum to propodeum (the middle three most strongly defined). Outside these on the pronotum some rugoreticulum is present around the anterior angles, but this is absent elsewhere on the dorsal alitrunk. Dorsal surfaces of petiole and postpetiole rugulose, gaster unsculptured. All dorsal surfaces of body with abundant fine pilosity. Colour bright orange-brown.

Holotype worker, **Madagascar**: Beforona, 500 m, Sept. 1974, forest humus and litter (*A. Peyrieras*) (MCZ, Cambridge).

T. isectum is closest related to *andrei* and *robustior*, but the combination of small eyes, bright orange-brown colour, concave pronotum and very sharply defined longitudinal sculpture easily isolates this species.

Tetramorium kelleri Forel

(Fig. 13)

Tetramorium (*Xiphomyrmex*) *kelleri* Forel, 1887 : 385. Syntype workers, MADAGASCAR: nr Tamatavé, bois de l'Ivondro (*C. Keller*) (MHN, Geneva; BMNH; MCZ, Cambridge; USNM, Washington) [examined].

WORKER. TL 4·9–5·3, HL 1·06–1·16, HW 0·90–0·98, CI 83–86, SL 0·84–0·94, SI 93–97, PW 0·72–0·82, AL 1·34–1·42 (8 measured).

Mandibles striate, median clypeal carina distinct. Frontal carinae strong, extended back nearly to the occipital margin and only very feebly curved so that they are roughly parallel throughout their length. Antennal scrobe a well-marked groove capable of holding the scape. Pronotal corners rounded in dorsal view. Metanotal groove absent to very weakly marked with the alitrunk in profile. Propodeal spines long and acute, the metapleural lobes low and rounded. Petiole in profile with the anterior and dorsal surfaces confluent through a broad curve or an extremely obtuse angle, the dorsum ascending posteriorly so that the anterior face of the node is distinctly shorter than the posterior. In dorsal view the petiole node much longer than broad. Head and dorsal alitrunk reticulate-rugose, the dorsal surfaces of the pedicel also rugose but here the rugae are longitudinal and are more strongly developed on the petiole than on the postpetiole. Gaster unsculptured. All dorsal surfaces of head and body with dense, long, fine hairs which are erect or suberect, and some of which are very long. Antennal scapes and legs also with abundant long, erect hairs, the longest on the scapes being almost or quite twice as long as the maximum scape width. Colour orange-brown.

Probably the most distinctive species of its group in the Malagasy region, the combination of large size, light colour, extreme hairiness and characteristic node shape makes *kelleri* immediately recognizable. Its nearest relatives do not appear to be any of the Malagasy species but rather it is closest related to *pilosum* Emery and *yerburyi* Forel of the Oriental region.

Tetramorium latreillei Forel

Tetramorium (*Xiphomyrmex*) *latreillei* Forel, 1895*a* : 247. Syntype workers, MADAGASCAR: Imerina oriental (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 4·7–5·1, HL 1·14–1·20, HW 1·04–1·12, CI 91–93, SL 0·90–0·94, SI 82–86, PW 0·74–0·80, AL 1·38–1·46 (4 measured).

Mandibles striate, median clypeal carina present. Frontal carinae long and strong, divergent throughout their length and directed towards the occipital corners posteriorly. Antennal scrobe a well-defined groove capable of holding the scape. Posteromedian portion of head, in front of the occipital margin, impressed, transversely concave. Metanotal groove absent. Propodeal spines long and strong, metapleural lobes low and rounded. Petiole node in profile subrectangular, with vertical and nearly parallel anterior and posterior faces and a feebly convex dorsum. Head, alitrunk and pedicel regularly longitudinally rugose, the pedicel segments more weakly so than the head and alitrunk, the petiole sometimes with a smooth mediodorsal strip. Erect hairs sparse, present only upon the head and pronotum, apparently not developed on mesonotum, propodeum or pedicel. First gastral tergite with fine greyish appressed pubescence but without hairs, the remaining tergites with hairs. Colour uniform dark brown to black.

In the Malagasy fauna a total of 8 species are now known in which the first gastral tergite lacks hairs. Four of these belong to the *schaufussi*-group, one to the *ranarum*-group and two to the *weitzeckeri*-group. *T. latreillei* is so far the only member of the *tortuosum*-group in which this character occurs, and it serves to separate easily this species from its close relatives.

MATERIAL EXAMINED

Madagascar: no loc. (*Staudinger*); no loc. (*Sikora*).

Tetramorium pleganon sp. n.

HOLOTYPE WORKER. TL 3·8, HL 0·92, HW 0·87, CI 97, SL 0·64, SI 74, PW 0·68, AL 1·10.

Mandibles with very faint, delicate longitudinal striation. Anterior clypeal margin with a very small median impression. Maximum diameter of eye 0·20. Frontal carinae strong, surmounted for most of their length by a narrow rim or flange, occipitally becoming indistinguishable from the surrounding sculpture. Antennal scrobes shallow but broad. Dorsal alitrunk transversely flattened, in dorsolateral view appearing only very weakly convex. Sides of alitrunk bluntly marginate. Propodeal spines elongate and strong, somewhat downcurved along their length. Metapleural lobes short-triangular, acute apically. Node of petiole in profile slightly higher than long, the anterolateral angle roughly a right-angle and the dorsum sloping posteriorly to the much more rounded posterodorsal angle. Postpetiole evenly convex. Dorsum of head regularly longitudinally rugulose, without occipital reticulation; about 11 rugulae between the frontal carinae at the level of the eyes, the spaces between them with very feeble ground-sculpture. Middle of dorsal alitrunk longitudinally rugose, with four roughly parallel strong rugae running from anterior pronotum to propodeum. Outside of these the rugae are more disorganized and meandering, with traces of a broken reticulum in places, especially on the pronotum. Petiole and postpetiole strongly rugose dorsally, the two about equally strongly sculptured. Basal third of first gastral tergite finely and densely reticulate-punctate. All dorsal surfaces of head and body with abundant fine hairs, dorsal surfaces of hind tibiae with suberect to subdecumbent short pilosity. Colour blackish brown, the appendages lighter.

PARATYPE WORKERS. As holotype, but with dimensions TL 3·7–4·0, HL 0·92–0·96, HW 0·88–0·92, CI 96, SL 0·66–0·70, SI 75–76, PW 0·66–0·69, AL 1·10–1·12. Eye diameter 0·18–0·20 (2 measured).

Holotype worker, **Madagascar**: 84 km SW. Sambava on road to Andapa, 70–160 m, 17.ii.1977 degraded for. AB 43, strays on path (*W. L. & D. E. Brown*) (MCZ, Cambridge).

Paratypes. Three workers with same data as holotype (MCZ, Cambridge; BMNH).

This is the only known Malagasy species with 11-merous antennae which has the first gastral tergite sculptured.

Tetramorium robustior Forel **stat. n.**

(Fig. 16)

Tetramorium (*Xiphomyrmex*) *andrei* st. *robustior* Forel, 1892 : 521. Syntype workers, MADAGASCAR: Forêt d'Andrangoloaka (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 4·6–4·9, HL 1·00–1·04, HW 0·98–1·02, CI 98–100, SL 0·80–0·82, SI 78–80, PW 0·74–0·78, AL 1·30–1·32 (3 measured).

Mandibles striate; median clypeal carina distinct. Frontal carinae strongly developed and sinuate, diverging to the level of the eyes, converging behind the eyes and then diverging again posteriorly, each carina directed towards the occipital corner but merging with the sculpture before reaching it. Antennal scrobe a well-defined groove capable of accommodating the scape. Posteromedian portion of head in front of the occipital margin transversely shallowly concave. Pronotum and mesonotum bluntly marginate laterally. Propodeal spines long and strong, metapleural lobes elongate triangular, dentiform and acute. Petiole node in profile roughly rectangular, slightly broader above than below due to the weak concavity of both the anterior and posterior faces; a second result of this concavity is that the antero- and postero-dorsal angles of the node slightly overhang the faces below them. In dorsal view the node longer than broad. Head regularly longitudinally rugose with a fine but conspicuous punctulation between the rugae. Dorsal surfaces of alitrunk and pedicel more coarsely longitudinally rugose. Gaster unsculptured. All dorsal surfaces of head and body with numerous fine, erect to suberect hairs. Leading edges of antennal scapes with short, suberect curved hairs, which are shorter than the maximum width of the scape.

T. robustior is close to *andrei* but is a more stockily built species with a slightly differently shaped petiole node, relatively broader head and shorter antennal scapes. In view of these differences it is my opinion that *robustior* is best treated as a good species, at least until more material is available and the variation of the two forms is known in more detail.

MATERIAL EXAMINED

Madagascar: no loc. (*Sikora*); Parc Nat. Mont. d'Ambre (*W. L. & D. E. Brown*); Bemanevika, Souspref. Bealanana (*A. Peyrieras*).

The *ranarum*-group

Antennae with 11 segments; sting appendage spatulate. Mandibles sculptured, usually striate, more rarely otherwise. Petiole strongly nodiform, many species in the group with postpetiole unsculptured but the petiole is usually sculptured to some extent. Small species with HW usually <0·80. Dorsal (outer) surfaces of hind tibiae with pubescence which is usually decumbent or appressed, only very rarely otherwise.

This small group of seven species is restricted to the Malagasy region. Their closest relatives appear to be the members of the African *angulinode*-group, but in them the mandibles are always smooth and unsculptured.

Tetramorium coillum sp. n.

(Fig. 21)

HOLOTYPE WORKER. TL 2·8, HL 0·72, HW 0·67, CI 93, SL 0·46, SI 69, PW 0·48, AL 0·78.

Mandibles coarsely longitudinally striate, anterior clypeal margin with a distinct notch or impression. Maximum diameter of eye 0·12, about 0·18 × HW. Frontal carinae strong to behind level of eyes, but fading out before they reach the occipital area and becoming confused with the remaining sculpture. Antennal scrobes very feeble, all of the scrobal area sculptured. Propodeal spines strong, feebly upcurved along their length, metapleural lobes triangular and acute. Petiole in profile strongly nodiform, with a sharp anterodorsal angle and with a minute peak at the angle due to the presence of a transverse dorsal carina. Posterodorsal angle of petiole rounded. Node of petiole in dorsal view as broad as long. Dorsum of head finely and irregularly longitudinally rugulose, with a conspicuous punctulate ground-sculpture between them, the rugulae forming a weak reticulum occipitally. Dorsal alitrunk reticulate-rugulose, the sculpture more strongly developed than on the head, the individual rugulae low and rounded, with a beaded appearance dorsally due to the presence of fine aligned punctulation. Spaces between reticular meshes mostly smooth. Petiole dorsum finely and densely rugulose, the postpetiolar dorsum with extensive shining areas but with some rugulae present, especially posterolaterally. Gaster unsculptured. Short, fine acute hairs present on all dorsal surfaces of head and body. Colour dark brown.

Paratype workers. As holotype, TL 2·7–2·8, HL 0·66–0·72, HW 0·62–0·66, CI 91–94, SL 0·44–0·47, SI 69–72, PW 0·45–0·47, AL 0·72–0·78. Maximum diameter of eye 0·11–0·12, about 0·17–0·19 × HW.

Holotype worker, **Madagascar**: Bemanevika, Souspref. de Bealanana, 20.x.1975, forest humus and litter, AB 46 (*A. Peyrieras*) (MCZ, Cambridge).

Paratypes. 12 workers and 2 dealate females with same data as holotype (MCZ, Cambridge; BMNH).

This small species is closest related to *ranarum* and *quasirum* but differs from both of these by retaining rugular sculpture on the postpetiole and by having the anterodorsal angle of the petiole node sharp.

Tetramorium degener Santschi

Tetramorium (*Yphomyrmex*) [sic] *degener* Santschi, 1911 : 124. Holotype worker, Madagascar (*J. de Gaulle*) (NM, Basle) [examined]. [Data label on holotype states: *T.* (*X.*) *ranarum* r. *degener*.]

Worker. TL 2·1–2·5, HL 0·58–0·60, HW 0·52–0·55, CI 89–93, SL 0·37–0·40, SI 69–74, PW 0·38–0·42, AL 0·60–0·66 (10 measured).

Mandibles longitudinally striate, anterior clypeal margin with a shallow notch or indentation medially which may be difficult to see in some specimens. Frontal carinae distinct to well beyond the level of the eyes but fading out in the posterior quarter of the head-length and becoming indistinguishable from the remaining cephalic sculpture. Antennal scrobes shallow but conspicuous in full-face view, the lower part of the scrobal area with reticular sculpture. Eyes of moderate size, maximum diameter *c.* 0·12, about 0·22 × HW. Propodeum with a pair of stout triangular spines, the metapleural lobes triangular and acute. Node of petiole in profile higher than the dorsum is long, with roughly parallel anterior and posterior faces and a feebly convex dorsum. In dorsal view the petiole node very slightly broader than long. Postpetiole evenly convex in profile. Head with fine longitudinal rugulation dorsally, which becomes reticulate occipitally. Interspaces with a very feeble superficial punctulation. Dorsal alitrunk reticulate-rugulose, best developed on the pronotum, the rugulae fine and sharply defined, not having a beaded appearance dorsally.

Postpetiole and gaster always unsculptured but the petiole dorsum often with traces of sculpture present. All dorsal surfaces of head and body with numerous fine hairs, mainly erect or suberect. Colour uniform light brown, the appendages lighter.

T. degener is a small species characterized by its moderately sized eyes and sharply defined sculpture. It is closest related to *quasirum*, a similar-sized species, but here the sculpture of the dorsal alitrunk is low and blunted, the upper surface with a beaded appearance due to the presence of fine aligned punctulation. Similar sculpture is present on the pronotum of *coillum* and *ranarum*, but this latter species averages larger and has relatively small eyes, and the former retains traces of rugulose sculpture on the postpetiole.

Material examined

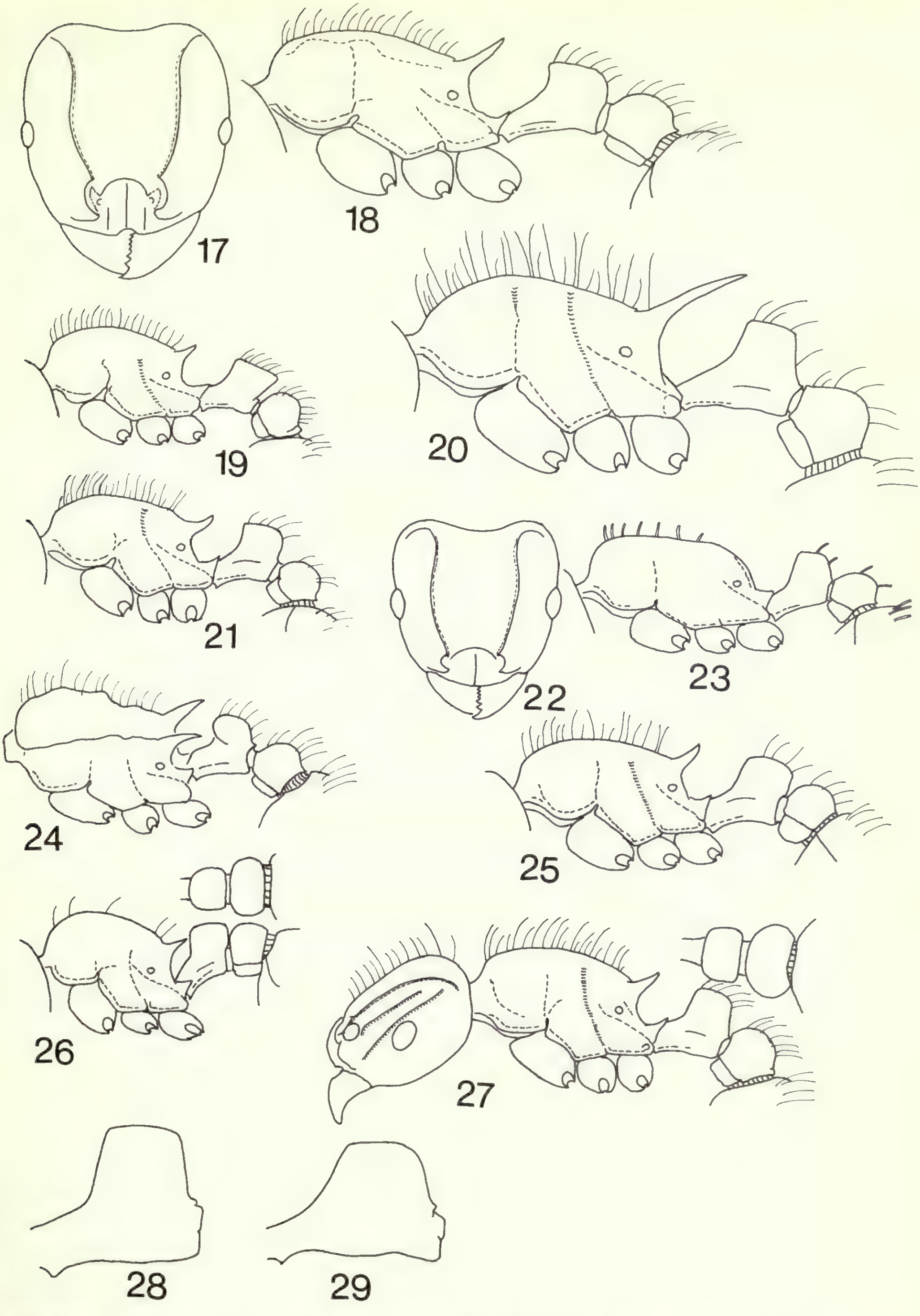
Madagascar: Périnet (*W. L. Brown*).

***Tetramorium ibycterum* sp. n.**

(Fig. 26)

Holotype worker. TL 2·5, HL 0·64, HW 0·61, CI 95, SL 0·43, SI 70, PW 0·44, AL 0·68.

Mandibles with delicate sculpture resembling feeble shagreening, not longitudinally striate. Anterior clypeal margin with a median impression or notch. Frontal carinae strongly developed and surmounted by a narrow rim or flange, forming the dorsal margin of a shallow but conspicuous broad scrobe. The scrobe is bounded ventrally by a feeble longitudinal carina, running above the eye, which also forms the posterior boundary of the scrobal area. Dorsal alitrunk in profile evenly convex, without trace of metanotal groove. Propodeal spines stout and acute, metapleural lobes triangular. Shape of pedicel segments as in Fig. 26, the petiole in dorsal view very slightly broader than long, the postpetiole conspicuously so. Dorsum of head finely but irregularly longitudinally rugulose with very feeble traces of a reticulum occipitally, the interspaces with very faint ground-sculpture. Dorsal alitrunk finely reticulate-rugulose, the meshes tending to be more conspicuous on the pronotum. Petiole and postpetiole with the faintest traces of ground-sculpture dorsally, almost smooth. Gaster unsculptured. Short fine hairs present on



Figs 17–29 *Tetramorium* workers. 17–27. Head and/or alitrunk of (17, 18) *isectum*, (19) *zenatum*, (20) *electrum*, (21) *coillum*, (22, 23) *anodontion*, (24) *dysalum*, (25) *ranarum*, (26) *ibycterum*, (27) *plesiarum*. 28, 29. Outline shape of petiole node in (28) *caldarium* and allies, (29) *scytalum*. Pilosity omitted from heads and from Figs 28 to 29.

dorsum of head but almost wholly confined to the dorsal surface of the frontal carinae. Longer fine, erect hairs present on dorsal alitrunk but very sparse, pronotum with 2 pairs, mesonotum with 1 pair, propodeum with 2 pairs in holotype, all located laterally where the dorsum meets the sides. Petiole, postpetiole and first gastral tergite without hairs, but the last with very fine appressed pubescence. Colour uniform light orange-brown.

Holotype worker, **Madagascar**: Côte Ouest, Jangoa, degraded for. litter, 18.i.1966 (*J-M. Betsch*) (MCZ, Cambridge).

In the *ranarum*-group *ibycterum* is unique in lacking any trace of pilosity on the first gastral tergite, and in this respect it resembles the *cognatum*-complex in the *schaufussi*-group. However, the shape of the petiole node and the presence of sculpture on the mandibles indicate that the true affinities of *ibycterum* lie with *ranarum* and its allies.

Tetramorium plesiarum sp. n.

(Fig. 27)

HOLOTYPE WORKER. TL 3·0, HL 0·74, HW 0·69, CI 93, SL 0·48, SI 69, PW 0·52, AL 0·84.

Mandibles very delicately longitudinally striate, anterior clypeal margin with a narrow median impression. Eyes moderate, maximum diameter 0·14, about 0·20 × HW, the maximum diameter with about 8 facets. Frontal carinae strong, surmounted by a narrow rim or flange and forming the upper margins of the strongly developed scrobes, which are bounded below by a strong longitudinal carina running above the eye and are divided into upper and lower portions by a strong median longitudinal carina which runs back well beyond the level of the posterior margin of the eye. The posterior margin of the scrobe is bounded by a downcurvature of the frontal carina which is directed towards the lower occipital corner (Fig. 27). Propodeum armed with a pair of narrow spines which are slightly upcurved along their length, the metapleural lobes elongate-triangular and acute. Petiole in profile high and quite narrow, the dorsal length less than the height of the tergal portion of the node. Postpetiole regularly convex. Petiole in dorsal view distinctly broader than long. Dorsum of head irregularly longitudinally rugulose, the interspaces with fine superficial punctulation. Dorsal alitrunk with spaced-out longitudinal rugulae, without transverse sculpture except on the extreme anterior pronotum. Spaces between rugulae glossy, with very feeble groundsculpture. Dorsal surfaces of petiole and postpetiole unsculptured although the sides of these segments have some dense but faint punctulation. Gaster unsculptured. All dorsal surfaces of head and body with abundant fine pilosity. Colour brown.

Holotype worker, **Madagascar**: Causse de Kelifely, 20–30.xi.1974, forest humus and litter, dry forest (*A. Peyrieras*) (MCZ, Cambridge).

From the overall appearance of this species, and especially because of the strongly developed scrobes and dense pilosity, it seems to be an attempt by a member of the *ranarum*-group to acquire a *Triglyphothrix*-like habitus (but of course without the branched hairs), and these characters separate it well from related species in this group. The development of the scrobe is along the same lines but less complete in *zenatum*, but in this species the petiole node has a characteristic and very distinctive shape (Fig. 19).

Tetramorium quasirum sp. n.

HOLOTYPE WORKER. TL 2·4, HL 0·64, HW 0·58, CI 91, SL 0·40, SI 69, PW 0·42, AL 0·70.

Mandibles longitudinally striate; anterior clypeal margin with a median notch or impression. Eyes relatively small, maximum diameter 0·12, about 0·21 × HW, the eye noticeably elongate, about twice longer than broad. Frontal carinae not strongly developed, behind the level of the eyes no more strongly marked than the cephalic rugular sculpture which they merge into posteriorly. Antennal scrobes shallow and inconspicuous but less strongly sculptured than remainder of head. Propodeal spines acute, feebly upcurved along their length; metapleural lobes bluntly triangular. Petiole in profile strongly nodiform with roughly parallel, vertical anterior and posterior faces and an evenly convex dorsum, the length of the dorsum about equal to the height of the tergal portion of the node. Antero- and posterodorsal angles of the node narrowly rounded in profile and blunt. In dorsal view the node slightly longer than broad. Postpetiole evenly convex in profile. Dorsum of head closely and irregularly longitudinally rugulose with some feeble cross-meshes, and merging into a disorganized reticulum posteriorly. Spaces between the rugulae conspicuously punctulate. Dorsal alitrunk reticulate-rugulose, more strongly marked than on head, the individual rugulae low and blunt, with a beaded appearance due to aligned punctulation on their upper surfaces. Spaces between them with feeble and sparse punctulation, less strong than on head. Dorsum of petiole with feebly marked sculpture, postpetiole and gaster smooth. All dorsal surfaces of head and body with numerous fine hairs, the gaster also with conspicuous long pubescence. Colour dark brown.

PARATYPE WORKERS. As holotype, some of them a lighter shade of brown. Dimensions TL 2·4–2·6, HL 0·62–0·64, HW 0·56–0·59, CI 90–94, SL 0·39–0·42, SI 69–73, PW 0·40–0·43, AL 0·69–0·72, maximum diameter of eye 0·11–0·12 (0·20–0·21 × HW) (10 measured).

Holotype worker, **Madagascar**: Bongolava, Pref. Tsiroanomandidy, 6–11.xii.1974, forest humus and litter, series AB 48 (*A. Peyrieras*) (MCZ, Cambridge).

Paratypes. 14 workers with same data as holotype (MCZ, Cambridge; BMNH).

NON-PARATYPIC MATERIAL

A second series consisting of 4 workers and a female bear the data **Madagascar**: Rte d'Anosibé, km 33, 4–12.iv.1975, forest humus and litter, AB 49 (*A. Peyrieras*). These match the type-series well but are darker in colour, being black or nearly black.

This small species is related to *ranarum* but is smaller, has slightly larger eyes and much less strongly developed frontal carinae.

Tetramorium ranarum Forel

(Fig. 25)

Tetramorium (*Xiphomyrmex*) *ranarum* Forel, 1895*b* : 486. Syntype workers, MADAGASCAR: central Madagascar (*Sikora*) (MHN, Geneva) [examined].

WORKER. TL 3·0–3·3, HL 0·72–0·82, HW 0·68–0·76, CI 94–97, SL 0·48–0·54, SI 67–71, PW 0·48–0·55' AL 0·80–0·88 (8 measured).

Mandibles strongly longitudinally striate, anterior clypeal margin with a median notch or impression. Eyes relatively small, maximum diameter *c.* 0·13–0·14, about 0·17–0·19 × HW. Frontal carinae strong and surmounted by a raised narrow rim or crest, occipitally becoming weaker and merging into the other cephalic sculpture. Antennal scrobes shallow but broad, the scrobal area with some rugulose sculpture. Propodeal spines elongate and strong, tending to be upcurved along their length. Metapleural lobes broadly triangular and acute. Petiole node in profile blocky, about as long dorsally as the tergal portion is high. In dorsal view the petiole node about as broad as long, in some specimens slightly broader than long and *vice versa* in others. Postpetiole evenly convex in profile, much broader than petiole in dorsal view. Head predominantly bluntly longitudinally rugulose with some cross-meshes and with a reticulum occipitally, the dorsal surfaces of the blunt rugulae with a beaded appearance due to the presence of aligned punctulae. Spaces between rugulae weakly punctulate. Dorsal alitrunk reticulate-rugulose, the rugulae more strongly developed than on the head but still blunt and with the same beaded appearance. Petiole dorsum with traces of rugular sculpture, the postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs. Colour medium to dark reddish brown.

T. quasirum and *coillum* are the species most closely related to *ranarum*, the three of them sharing a similar habitus but differing in detail. Thus, *quasirum* is a noticeably smaller species than *ranarum* with relatively larger eyes, and *coillum* has the petiole more sharply angulate and retains rugulose sculpture on the postpetiole.

MATERIAL EXAMINED

Madagascar: Périnet (*W. L. Brown*); Andasibé (=Périnet) (*W. L. & D. E. Brown*).

Tetramorium zenatum sp. n.

(Fig. 19)

HOLOTYPE WORKER. TL 2·6, HL 0·64, HW 0·60, CI 94, SL 0·42, SI 70, PW 0·47, AL 0·72.

Mandible coarsely longitudinally striate, anterior clypeal margin with a distinct notch or impression.

Frontal carinae strong and surmounted by a narrow rim or flange, posteriorly weaker and curving downwards around the posterior part of the scrobe, not becoming confused with the sculpture of the occipital region. Scrobes shallow but broad, bounded below by a longitudinal carina running above the eye which is upcurved posteriorly and confluent with the downcurved frontal carina. Anteriorly the scrobe divided into upper and lower portions by a feeble median carina which ends just beyond the level of the eye. Eyes with maximum diameter 0·11, about 0·18 × HW. Propodeal spines short and acute, the metapleural lobes elongate-triangular. Petiole in profile very distinctly shaped, see Fig. 19, the dorsum flat. In dorsal view the node about as long as broad. Dorsum of head irregularly finely rugulose, forming a reticulum occipitally. Spaces between rugulae with a punctulate ground-sculpture. Dorsal alitrunk reticulate-rugulose, the dorsal surfaces of the rugulae feebly punctulate. Petiole node finely rugulose, the postpetiole and gaster unsculptured, smooth and shining. All dorsal surfaces of head and body with numerous short, fine hairs. Colour orange-brown.

PARATYPE WORKER. As holotype but teneral and without full adult colour. Slightly smaller than holotype, TL 2·5, HL 0·62, HW 0·56, CI 90, SL 0·42, SI 75, PW 0·45, AL 0·69. The eye with maximum diameter 0·10.

Holotype worker, **Madagascar**: Causse de Kelifely, 20–30.xi.1974, forest humus and litter, dry forest AB 47 (*A. Peyrieras*) (MCZ, Cambridge).

Paratypes. One worker and one dealate female with same data as holotype (MCZ, Cambridge; BMNH).

This species is closest related to *plesiarum*, both species sharing a similar strong development of the antennal scrobes, but the unique shape of the petiole node of *zenatum* quickly separates it from *plesiarum*, compare Figs 19 and 27. Also, the carina forming the lower scrobe margin is confluent with the frontal carina posteriorly in *zenatum*, but in *plesiarum* the two do not join, as indicated in Fig. 27.

The *tosii*-group

Antennae with 12 segments, sting appendage dentiform. Mandibles sculptured. Anterior clypeal margin entire, without trace of a median notch or impression. Body with erect or suberect fine hairs present but dorsal (outer) surfaces of hind tibiae without such hairs. Petiole node in profile elongate and low (Figs 31, 33). Frontal carinae running back well beyond the level of the eyes. Large species, HW > 0·90. Antennal scrobes absent.

The two species in this small group represent the only endemic members of *Tetramorium* in the entire Malagasy region in which the antennae are 12-merous and which are not obviously derived from any based on the Ethiopian region.

Tetramorium tantillum sp. n.

(Figs 30, 31)

HOLOTYPE WORKER. TL 4·5, HL 1·09, HW 0·92, CI 90, SL 0·74, SI 80, PW 0·70, AL 1·22.

Mandibles with faint and delicate longitudinal striation, the anterior clypeal margin arcuate and entire. Clypeus medially with only three longitudinal carinae. Eyes moderate, maximum diameter 0·21, about 0·23 × HW, not strongly protuberant. Frontal carinae long, almost reaching occipital region before merging with other cephalic sculpture, but not strong, no more strongly developed than the longitudinal rugae between them. The frontal carinae very weakly sinuate along their length, broadest at about level of eyes and converging slightly posteriorly, not diverging towards the occipital corners. Outline shape of lateral alitrunk as in Fig. 31. Propodeal spines straight and acute, metapleural lobes broad and bluntly triangular. Pedicel in profile as in Fig. 31, in dorsal view the petiole node roughly globular, very slightly broader than long and distinctly more voluminous than the postpetiole. Dorsum of head with irregular longitudinal rugae which are widely spaced, about 7 between the frontal carinae at the level of the eyes. Spaces between rugae with feeble ground-sculpture which amounts to little more than a slight roughening of the surface. Dorsal alitrunk with low, rounded, very weak rugae which form a feeble, almost effaced reticulum on the promesonotum. Dorsal surfaces of petiole and postpetiole smooth, with superficial faint markings which resemble an almost effaced fine reticulate-punctulation. Sides of petiole node with a few vestigial rugulae. Gaster unsculptured. All dorsal surfaces of head and body with numerous hairs, mostly erect or sub-erect. Colour uniform dark brown.

PARATYPE WORKERS. TL 4·2–4·4, HL 1·00–1·02, HW 0·88–0·90, CI 88–90, SL 0·70–0·74, SI 79–82, PW 0·64–0·68, AL 1·12–1·88. Maximum diameter of eye 0·19–0·21 (3 measured).

Holotype worker, **Madagascar**: Mangabé Isl., Antongil Bay 19.ii.1977, prim. rain forest, AB 42 litter (*W. L. & D. E. Brown*) (MCZ, Cambridge).

Paratypes. 3 workers with same data as holotype (MCZ, Cambridge; BMNH).

Closely related to *tosii* but not as specialized as that species. The eyes in *tantillum* are much less prominent, the scapes and propodeal spines shorter, and the petiole node is constructed differently (Figs 30, 31 and 32, 33).

Tetramorium tosii Emery

(Figs 32, 33)

Tetramorium tosii Emery, 1899 : 284, fig. Syntype worker, MADAGASCAR: Bai d'Antongil (*Mocquerys*) (MHN, Geneva) [examined].

WORKER. TL 5·2, HL 1·14, HW 0·98, CI 86, SL 0·96, SI 98, PW 0·76, AL 1·40.

Mandibles striate, anterior clypeal margin convex and entire. Clypeus with three very sharply raised longitudinal carinae running its length. Frontal carinae strong, running back well beyond the level of the eyes, becoming indistinguishable from the rugoreticulum on the occipital corners. Antennal scapes moderately long, SI approaching 100. Eyes unique in the genus, moderately sized but very strongly protuberant, projecting on each side of the head as a dome-shaped, strongly convex hemisphere. Occipital margin broadly and deeply concave in full-face view. Outline shape of alitrunk as in Fig. 33. Propodeum armed with a pair of very long, narrow, acute spines; metapleural lobes broadly triangular and feebly upcurved. Petiole in profile with an extremely long, curved peduncle anteriorly and with a long, low node which slopes upwards posteriorly. Shape of petiole in lateral and dorsal view as in Fig. 33. Dorsum of head sculptured with five coarse longitudinal rugae or carinae between the frontal carinae, the dorsal surfaces of which are finely beaded. A loose reticulum formed by widely spaced cross-meshes is present occipitally, and a reticulum is more strongly developed on the sides above and behind the eyes. Dorsal alitrunk largely unsculptured, with only scattered vestiges of low rugulae, the spaces between which are shining and have a fine superficial reticular ground-sculpture. Sides of pronotum much more strongly sculptured than dorsum. Sides of petiole with rugulose sculpture, but the dorsum and the entire postpetiole only with fine, faint superficial punctulation. First gastral tergite with faint superficial minute reticular markings, otherwise unsculptured. All dorsal surfaces with numerous fine erect or suberect hairs but these absent from the appendages where only fine pubescence is present. Colour uniform dark reddish brown, the gaster slightly darker in shade than the head and alitrunk.

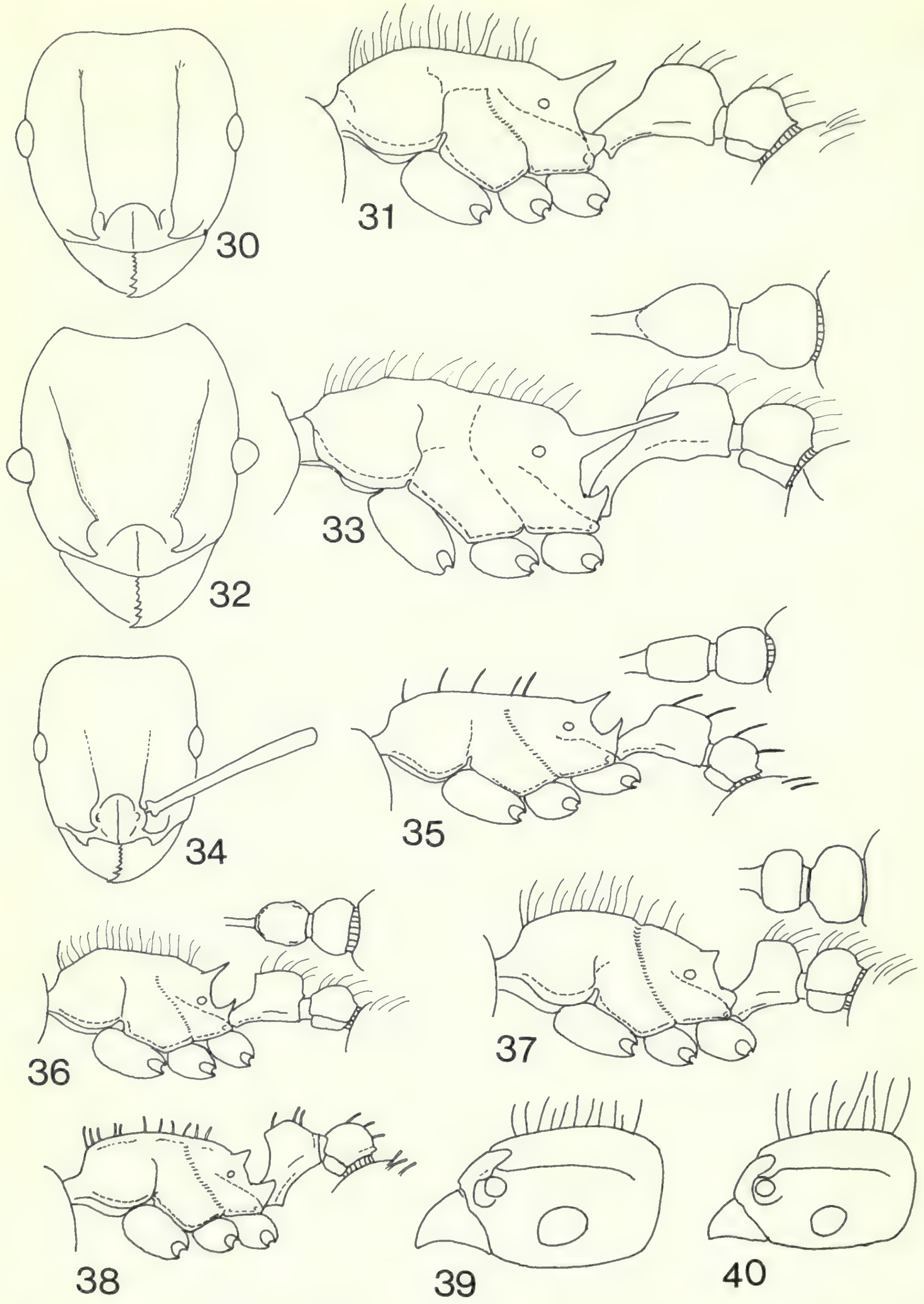
This large and spectacular species is not referable to any other species-group except in the vaguest ways. Its affinities seem to lie in the direction of the *tortuosum*-group, but there the antennae have only 11 segments and the sting appendage is spatulate, whereas in *tosii* the antennae are 12-merous and the sting appendage is pennant-shaped.

T. tosii should not be confused with any other Malagasy species as its combination of 12-merous antennae and unique eye-structure makes it immediately recognizable. It is separable from *tantillum*, its only known relative, by the different eye structure, size, shape of petiole and length of propodeal spines (compare Figs 30, 31 and 32, 33).

The *sericeiventre*-group

Antennae with 12 segments. Mandibles longitudinally striate. Anterior clypeal margin entire, without a median notch or impression. Lateral portions of clypeus modified, appearing roughly dentiform in full-face view (Fig. 34) but with the head viewed from above and slightly behind the raised lateral portions of the clypeus are seen to rise to a distinct high angular peak in front of the antennal insertions and then slope steeply down towards the median portion. Frontal carinae feeble or absent, never extending beyond eyes. Antennal scapes long, SI > 100; antennal scrobes absent. Propodeum bispinose. Petiole in dorsal view longer than broad. Sting appendage triangular to dentiform.

This group is strictly African and contains about a dozen species on that continent, most of which are arid-ground forms feeding largely or exclusively on ants of the genus *Pheidole*. Two species,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Figs 30–40 *Tetramorium* workers. Head and/or alitrunk of (30, 31) *tantillum*, (32, 33) *tosii*, (34, 35) *sericeiventre*, (36) *lucayanum*, (37) *caespitum*, (38) *simillimum*, (39) *bicarinatum*, (40) *insolens*. Pilosity omitted from heads.

in fact the two most common African species, have established themselves in the Malagasy region. In this region *sericeiventre* is known only from Madagascar, but *quadrispinosum* is more widely distributed, occurring also on several of the smaller island systems of the region.

Both of these species will be dealt with in more detail in the section of this study dealing with the Ethiopian regional fauna and so only summary treatment is given to them here.

Besides having the species-group characters noted above, both species have a number of stout, blunt hairs arising sparsely on the promesonotum, pedicel segments and gaster, but such hairs are absent from the propodeal dorsum. Both species are reddish in colour, usually with the gaster darker (sometimes black) but sometimes with very little difference in shade between alitrunk and gaster. The antennal scapes and the middle and hind tibiae lack standing hairs of any description and the petiole node in profile is long and low (Fig. 35). Differences between the two species rest rather uneasily upon the variable character of density and intensity of sculpture as tabulated in the key. In reality it is quite possible that *quadrispinosum*, a feebly or unsculptured form, and *sericeiventre*, a strongly sculptured form, may represent extremes of a single variable species.

For the present the two forms may be summarized as follows.

Tetramorium quadrispinosum Emery

Tetramorium quadrispinosum Emery, 1886 : 362, pl. 17, fig. 8. Syntype workers, SOUTH AFRICA: Cape of Good Hope (*L. Peringuey*) (MRAC, Tervuren; MHN, Geneva) [examined].

Tetramorium blochmanii var. *montanum* Forel, 1891*a* : 152, pl. 5, fig. 2a. Syntype workers, MADAGASCAR: nr Tamatave, Bois de l'Ivondrona (*C. Keller*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. With the group-characters given above and separable from *sericeiventre* only in terms of sculpture, which in *quadrispinosum* is feeble. In most specimens the entire dorsum of the head and alitrunk has only weak superficial punctulation or a surface reticulation, but in some a few faint longitudinal rugulae may be developed on the head, the alitrunk, or both. The gaster is often unsculptured but in some may have a superficial reticulation or a narrow band of feeble punctulation close to the base of the first tergite.

This species is widespread in southern Africa and is present in Madagascar. It appears to be fairly common on Aldabra I. and Cosmoledo Atoll.

Tetramorium sericeiventre Emery

(Figs 34, 35)

Tetramorium sericeiventre Emery, 1877 : 370. Syntype worker, ETHIOPIA: Sciotel (*Beccari*) (MHN, Geneva) [examined].

Tetramorium blochmanii Forel, 1887 : 384. Syntype workers, MADAGASCAR: nr Tamatave, Bois de l'Ivondro (*C. Keller*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. Very close to the above but more strongly sculptured. The dorsal surfaces of the head and alitrunk with conspicuous longitudinal rugae, the spaces between which are filled with a dense reticulate-puncturation and are matt and dull. The first gastral tergite is usually completely sculptured, matt and dull, but in a few the sculpture is distinctly stronger on the basal half of the tergite than on the apical.

T. sericeiventre is perhaps the commonest member of its genus in Africa in arid or semi-desert conditions or in any locality where the soil is insolated, sandy and well drained. It occurs from the Mediterranean littoral to the Cape and from the western to the eastern coasts. In the Malagasy region it is decidedly less common and appears to take second place to *quadrispinosum*.

The ***simillimum***-group

For definition of the group see page 169.

Madagascar has five representatives of this successful group of small species, two of which are restricted to the region (*anodontion* and *scytalum*) although closely related to the African parent-stock of the group. The other three species are shared with the Ethiopian region, one of them being very widespread in eastern and southern Africa (*delagoense*), whilst the final two, *simillimum* and *caldarium*, are both accomplished tramp species with a very wide distribution outside Africa, their place of origin. These two tramp species are discussed under the section dealing with the New World fauna.

Tetramorium anodontion sp. n.

(Figs 22, 23)

HOLOTYPE WORKER. TL 2·6, HL 0·68, HW 0·60, CI 88, SL 0·48, SI 80, PW 0·42, AL 0·74.

Mandibles appearing dull and finely shagreened. (This appears to be an artifact caused by the presence of a waxy layer on the surface of the mandibular blades. In thoroughly cleaned paratypes the mandibles are shining with scattered pits.) Anterior clypeal margin entire, without notch or impression medially. Frontal carinae strong, convex along their length and surmounted by a narrow rim or flange, tending to peter out occipitally and become indistinguishable from the remaining sculpture. Eyes of moderate size, their maximum diameter 0·15, about 0·25 × HW. With the head in full-face view the sides immediately behind the eyes lacking a projecting stout hair. Outline of alitrunk as in Fig. 23, the metanotal groove very weakly marked. Propodeum absolutely unarmed, without trace of spines or teeth. Metapleural lobes broad and bluntly triangular. Node of petiole in dorsal view broader than long. Dorsum of head strongly sculptured, with numerous fine longitudinal rugulae and the interspaces packed with conspicuous reticulate-puncturation which also covers the scrobal areas. Dorsal alitrunk, petiole and postpetiole finely reticulate-rugulose, all interspaces covered by dense, distinctive reticulate-puncturation. First gastral tergite with faint shagreening basally but otherwise unsculptured. Short, stout, blunt hairs present on all dorsal surfaces of head and body. Colour medium brown, dull.

PARATYPE WORKERS. TL 2·5–3·1, HL 0·62–0·76, HW 0·57–0·68, CI 88–93, SL 0·45–0·54, SI 76–80, PW 0·40–0·47, AL 0·72–0·86 (18 measured). Maximum diameter of eye 0·14–0·17, about 0·24–0·25 × HW. As holotype but in a number of workers the waxy layer on the body has been lost so that in some the gaster appears dull, in others polished. In the clean specimens the shagreening of the first gastral tergite is more conspicuous.

Holotype worker, **Madagascar**: 'Bekonazy to 5 km S. forest W baobabs (n. of Morondava) 24 Mar. 1969, dry forest. M214, rot. pod of legum tree, shade' (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 28 workers with same data as holotype (MCZ, Cambridge; BMNH).

T. anodontion is unique in the Malagasy fauna of *Tetramorium* as it is the only species yet discovered in which the propodeum is completely unarmed.

Tetramorium delagoense Forel **stat. n.**

Tetramorium simillimum st. *delagoense* Forel, 1894 : 80. Syntype workers, queens, males, MOZAMBIQUE: Delagoa (*Dr Liengme*) (MHN, Geneva) [examined].

Tetramorium simillimum var. *madecassum* Forel, 1895*a* : 248. Holotype worker, MADAGASCAR: Imerina (*Sikora*) (MNH, Geneva) [examined]. **Syn. n.**

WORKER. TL 2·3–2·8, HL 0·56–0·66, HW 0·49–0·58, CI 84–89, SL 0·42–0·52, SI 84–92, PW 0·33–0·41, AL 0·61–0·80 (25 measured).

Mandibles finely sculptured with dense, weak striation or dense shagreening. Anterior clypeal margin entire. Frontal carinae strongly developed, extending back almost to the occiput and distinctly more strongly developed than the remaining cephalic sculpture. Antennal scrobes broad and quite shallow, but distinct. With the head in full-face view the sides immediately behind the eyes with a single short, stout hair projecting anteriorly. Alitrunk in profile usually with a slight indentation at the metanotal groove. Propodeal spines usually short and broadly triangular, sometimes reduced and blunted but never absent, the spines shorter than the metapleural lobes which are themselves broadly triangular in shape. Petiole node in profile somewhat variable in shape but usually the same as in *simillimum* (Fig. 38). In dorsal view the node broader than long. Dorsum of head longitudinally rugulose, the spaces between rugulae packed with a dense, conspicuous reticulate-punctate ground-sculpture or densely granular. Dorsal alitrunk finely rugulose, with distinct punctulation between the rugulae. Dorsal surfaces of petiole and postpetiole similarly but more faintly sculptured. All dorsal surfaces of head, alitrunk and gaster with scattered short, stout, blunt hairs. Colour yellowish brown to mid-brown.

This small species is a very close sibling of *simillimum* and was originally described as a variety of it. However, it differs consistently from *simillimum* by possessing a single projecting stout hair on the side of the head just below the eye, a feature absent from *simillimum*. Also, the scapes of *delagoense* tend to be relatively slightly longer, with SI 84–92, as opposed to SI 74–80 in *simillimum*.

Although known from Madagascar, *delagoense* does not appear to be very common there. It is an African species which has spread to Madagascar and it is common in eastern and southern Africa, being known from numerous collections from South Africa, Rhodesia, Angola, Tanzania, Kenya and Sudan.

MATERIAL EXAMINED

Madagascar: Bekonazy (nr Morondava) (*W. L. Brown*); Imerintsiatosika (nr Tananarivo) (*W. L. Brown*).

Tetramorium scytalum sp. n.

(Fig. 29)

HOLOTYPE WORKER. TL 2·1, HL 0·52, HW 0·45, CI 87, SL 0·36, SI 80, PW 0·33, AL 0·58.

Mandibles unsculptured except for scattered small pits; anterior clypeal margin entire. Frontal carinae feeble, beyond the level of the midlength of the eye not more strongly developed than the cephalic rugular sculpture, merely narrow, slightly raised continuous lines which fade out before reaching the occiput. Antennal scrobes vestigial. Eyes moderately developed, with 6–7 ommatidia across the greatest diameter. With the head in full-face view the sides behind the eyes weakly convex, rounding into the occipital margin which is very feebly concave medially. Sides of head behind eyes without projecting hairs although some faint, very short pubescence may be present. Propodeum armed with a pair of minute triangular denticles which are much shorter than the broad, triangular metapleural lobes. Node of petiole in profile characteristically shaped, quite long and low, with rounded angles and tapering from a broader base to a narrower apex, both anterior and posterior faces sloping inwards. In dorsal view the node is about as long as broad. Dorsum of head with widely spaced, very fine longitudinal rugulae, the spaces between them shining and with only faint superficial reticulation. Dorsal alitrunk similarly but less regularly and more weakly sculptured, with a tendency for the rugulae to break or fade out. Pedicel segments feebly sculptured, the gaster smooth. All dorsal surfaces of head and body with numerous short, stout, blunt hairs; the appendages with fine appressed pubescence. Colour dark blackish brown, the appendages somewhat lighter.

PARATYPE WORKERS. As holotype, measuring TL 2·0–2·2, HL 0·52–0·56, HW 0·44–0·48, CI 84–87, SL 0·35–0·40, SI 80–85, PW 0·32–0·35, AL 0·55–0·62 (12 measured). Some paratypes lighter brown than the holotype.

Holotype worker, **Madagascar**: Bekonazy to 5 km S, forest w. baobabs (N. of Morondava), 27.iii.1969, dry forest (*W. L. Brown*) (written beneath the lower data label is 'pile of baobob chips') (MCZ, Cambridge).

Paratypes. 14 workers with same data as holotype (MCZ, Cambridge; BMNH).

Diagnostic features of this small species include the shape of the petiole node and the unsculptured mandibles. It occurs quite commonly on Aldabra as indicated by 5 short series collected by V. Spaull in 1974–75 (BMNH) and a series collected by Cogan and Hutson in the same islands. These specimens resemble the type-series closely, the shape of the petiole being the same, but in a few faint traces of sculpture are present on the mandibles, there is a tendency for the alitrunk to be more strongly sculptured, and the colouring tends to be lighter brown than in the Malagasy material, although some are quite as dark brown as the types. The size range of the Aldabra material overlaps the range given for the paratypes, with some workers being slightly larger: HL 0·52–0·60, HW 0·44–0·52, CI 84–87, SL 0·36–0·42, SI 80–85, PW 0·32–0·36, AL 0·55–0·64 (12 measured).

New World species

The New World fauna of *Tetramorium*, including those species formerly placed in the junior synonym *Xiphomyrmex*, consists of 11 species, 7 of which are introduced and 4 of which belong to the endemic Nearctic *spinosum*-complex.

Of the introduced forms it has always been accepted that *simillimum*, *pacificum* and *bicarinatum* (this last referred to in earlier literature as *guineense*; see Bolton, 1977) were introduced in the past (M. R. Smith, 1943; Creighton, 1950; Brown, 1957), and more recently Brown (1964*a*) has proved that a similar origin is definite for *lucayanum*. There was some controversy over the status of *caespitum*, with Smith (1943) believing the species to be introduced and Creighton (1950) maintaining that it was endemic. Brown (1957) set out the argument for *caespitum* being an introduced form and on the whole I agree with his conclusions. In the same paper Brown also pointed out that debate over the origins of *T. rugiventris* was misplaced as the species belonged in fact to genus *Myrmica* (but see Gregg, 1961).

The present survey has shown that seven introduced *Tetramorium* species are present in the New World fauna, rather than five as implied in the latest previous estimate (Brown, 1964*a*). The two extra taxa both arise from the fact that more than one distinct species has been confused under a single name in both *simillimum* and *bicarinatum* in the past. *T. insolens* has been detected in a number of collections under *bicarinatum*, to which it is superficially very similar, but from which it differs consistently, and is now known as an introduction in Britain, Germany and the U.S.A. *T. caldarium*, long given as a synonym of *simillimum*, is actually quite distinct and appears to be reasonably common in the New World as to the present I have seen samples from the U.S.A., Mexico, Puerto Rico, Haiti, Dominican Republic, Colombia, Brazil and Peru.

Turning to the endemic forms, all of which belong to the *spinosum*-complex of the *tortuosum*-group, there seems to have been tacit agreement in all the above-mentioned publications, and in the first part of the present survey (Bolton, 1976), that only a single species was present, *spinosum*, represented by four subspecies in the more arid zones of southern U.S.A. and Mexico. These forms were reviewed and redescribed by M. R. Smith (1938) and his key was reproduced later by Creighton (1950) who, however, omitted the 'typical' Mexican form. From the material which I have examined I consider now that four more or less well-defined species are present in this complex which do not correspond to the old subspecies. This amounts to a fairly radical departure from the previously accepted taxonomy of the complex, and its validity or lack of it must stand or fall by the acquisition of further collections. The reasons for these revisionary changes are discussed under the species-group heading and under the individual species.

The list below tabulates a number of names from the New World which were described in *Tetramorium* but have since been removed to other genera. Details of original descriptions and authorities for the generic transfers are given.

Species excluded from *Tetramorium*

Tetramorium auropunctatum Roger, 1863 : 182. Transferred to genus *Wasmannia* Forel by Forel, 1893 : 383.

Tetramorium* (*Cephalomorium*) *bahai Forel, 1922 : 91. Transferred to genus *Pheidole* Westwood by Santschi, 1925 : 228.

Tetramorium balzani Emery, 1894 : 165. Transferred to genus *Hylomyrma* Forel by Brown, 1953 : 3 (via genus *Lundella* Emery. See also Kempf, 1973; Bolton, 1976).

Tetramorium foreli Emery, nomen nudum of Forel, 1893 : 383. Later described as *Rogeria foreli* Emery, 1894 : 191.

Tetramorium peritulum Cockerell, 1927 : 165. Transferred to genus *Lasius* F. by Carpenter, 1930 : 58 (see also Wilson, 1955 : 58).

Tetramorium reitteri Mayr, 1887 : 621. Transferred to genus *Hylomyrma* Forel by Brown, 1953 : 3 (via genus *Lundella* Emery. See also Kempf, 1973; Bolton, 1976).

Tetramorium rugiventris M. R. Smith, 1943 : 4. Transferred to genus *Myrmica* Latreille by Brown, 1957 : 6 (later placed in weak satellite genus *Paramyrmica* Cole, by Gregg, 1961 : 215).

Tetramorium sigmoidea Mayr, 1884 : 33. Transferred to genus *Wasmannia* Forel by Forel, 1893 : 383.

Tetramorium silvestrii Santschi, 1909 : 6. Transferred to genus *Leptothorax* Mayr by Emery, 1922 : 258 (see also Creighton, 1950).

Synonymic list of New World species

***tortuosum*-group**
- ***hispidum*** (Wheeler) **comb. et stat. n.**
- ***mexicanum*** **sp. n.**
- ***placidum*** **sp. n.**

- ***spinosum*** (Pergande) **comb. n.**
    - *wheeleri* Forel **syn. n.**
    - *spinosus* subsp. *insons* Wheeler **syn. n.**

***bicarinatum*-group**
- ***bicarinatum*** (Nylander)
- ***insolens*** (F. Smith)
- ***pacificum*** Mayr

***simillimum*-group**
- ***caldarium*** (Roger) **stat. rev.**
    - *pusillum* var. *hemisi* Wheeler **syn. n.**
    - *antipodum* Wheeler **syn. n.**
    - *minutum* Donisthorpe **syn. n.**
- ***simillimum*** (F. Smith)

***caespitum*-group**
- ***caespitum*** (L.)
    - *brevinodis* var. *transversinodis* Enzmann
    - *caespitum* var. *immigrans* Santschi **syn. n.**

***camerunense*-group**
- ***lucayanum*** Wheeler
    - *camerunense* var. *waelbroeki* Forel
    - *lucayanum* var. *sexdens* Forel
    - *rectinodis* Menozzi

Key to species (workers)

1 Antennae with 11 segments 2

– Antennae with 12 segments 5

2 Longest hairs projecting from antennal scapes and from dorsal (outer) surfaces of hind tibiae longer than the maximum width of the appendage from which they arise (Figs 52, 54). SI in range 94–99. (Mexico: Nayarit, Jalisco) . . . . . . ***mexicanum*** (p. 161)

– Longest hairs projecting from antennal scapes and from dorsal (outer) surfaces of hind tibiae much shorter than the maximum width of the appendage from which they arise (Figs 50, 55). SI in range 79–90 3

3 Dorsum of postpetiole unsculptured. Small species, HW range 0·66–0·72. (Mexico: Nayarit, Jalisco) . . . . ***placidum*** (p. 162)

– Dorsum of postpetiole sculptured. Larger species, HW range 0·77–>1·00 4

4 Eyes relatively large, maximum diameter 0·26 × HW at minimum, usually more. Hairs on pronotal dorsum and on upper frontal carinae short and straight, usually stubble-like, shorter than the maximum diameter of the eye. (U.S.A.: Texas, Arizona) ***hispidum*** (p. 161)

– Eyes relatively small, maximum diameter 0·25 × HW at maximum, usually less. Hairs on pronotal dorsum and on upper frontal carinae long, fine and often curved, many of them longer than the maximum diameter of the eye. (U.S.A.: Texas, Arizona. Mexico: Nuevo Leon, Sonora, Baja California, Nayarit, Jalisco, Michoacan, Zacatecas) ***spinosum*** (p. 163)

5 Hairs on promesonotal dorsum sparse, uniformly short, stout and blunt; the longest of them much shorter than the maximum diameter of the eye (Fig. 38) 6

– Hairs on promesonotal dorsum dense, uniformly elongate, slender and acute apically; the longest of them at least as long as the maximum diameter of the eye (Figs 36, 37, 43–45) 7

6 Frontal carinae strongly developed throughout their length, sinuate, running unbroken almost to the occipital margin and surmounted throughout their length by a narrow raised rim or flange. The whole of the frontal carinae much more strongly developed than the remaining cephalic rugulae (Fig. 41). Ground-sculpture of head between frontal carinae strongly granular or reticulate-punctulate, the surfaces matt. Antennal scrobes shallow but broad and conspicuous. (Cosmopolitan tramp species) . . . . ***simillimum*** (p. 170)

– Frontal carinae more feebly developed, weakly or not sinuate, most strongly developed to level of midlength of eye behind which they become very weak, or broken, or gradually fade out posteriorly; not surmounted by a raised rim or flange beyond the level of the midlength of the eye, behind which the carinae are faint (Fig. 42). Ground-sculpture of head between carinae feeble, the surfaces dully shining. Antennal scrobes vestigial. (Tramp species mostly in tropics and subtropics) . . . . ***caldarium*** (p. 169)

7 Dorsum of head behind level of eyes with regular longitudinal rugulation, without a rugoreticulum occipitally 8

– Dorsum of head behind level of eyes with a coarse rugoreticulum, at least occipitally. . 9

8 Petiole in dorsal view longer than broad (Fig. 36). Frontal carinae strongly developed, reaching back beyond level of eyes (Fig. 48). Mandibles unsculptured or at most with very weak longitudinal markings. (Introduced in Caribbean countries) . . ***lucayanum*** (p. 172)

– Petiole in dorsal view broader than long (Fig. 37). Frontal carinae feeble, absent or indistinguishable from other cephalic sculpture (Fig. 49). Mandibles coarsely longitudinally striate. (Established in northern and eastern states of U.S.A., sporadically introduced elsewhere in New World) . . . . ***caespitum*** (p. 171)

9 Mandibles sculptured with fine dense longitudinal striation or dense shagreening. Hairs on upper surface of frontal carinae between antennal insertions and occipital corners shorter than maximum diameter of eye (Fig. 39). Head and alitrunk yellow-brown to bright orange-brown, gaster much darker, blackish brown. (Cosmopolitan tramp species; widespread in Neotropics) . . . . ***bicarinatum*** (p. 164)

– Mandibles smooth and shining with scattered pits. Hairs on upper surface of frontal carinae between antennal insertions and occipital corners longer than maximum diameter of eye (Fig. 40). Uniformly yellow or dark brown species, not bicoloured as above . . . 10

10 Uniformly clear yellow to light orange-brown, usually with the gaster lighter in shade than the alitrunk. First gastral tergite without basal costulae. (Sporadically introduced in New World) . . . . ***insolens*** (p. 165)

– Uniformly dark brown or blackish brown. First gastral tergite with basal costulae. (Sporadically introduced in New World) . . . . ***pacificum*** (p. 168)

The ***tortuosum***-group

Antennae with 11 segments, sting appendage spatulate. Petiole nodiform and usually sculptured, at least on the sides; in dorsal view commonly longer than broad. Anterior clypeal margin often with a median notch or impression. Propodeum armed with spines or teeth. Mandibles striate. Dorsum of head generally with coarse rugose or rugulose sculpture but without strong ground-sculpture. Antennal scapes with SI $<$ 100 in most species, rarely slightly greater.

The endemic American–Mexican species *hispidum*, *mexicanum*, *placidum* and *spinosum* belong to a single tight-knit complex within this large group, the older species of which were originally described in genus *Xiphomyrmex*, now synonymized with *Tetramorium*.

The taxonomic history of the complex begins with the description by Pergande (1896) of *X. spinosus* from Baja California, the first endemic true tetramoriine to be recorded from the New World. This was followed in 1901 by *Tetramorium* (*Xiphomyrmex*) *wheeleri* Forel, also described from Mexico, and a little later by the description of two subspecies of *spinosus* from the U.S.A., *insons* and *hispidum* from Texas and Arizona respectively, which were named by Wheeler in 1915. Here the situation rested until the constituents were reviewed by M. R. Smith (1938), who regarded the complex as consisting of a single species with four subspecies corresponding to the names *spinosus*, *hispidus*, *insons*, *wheeleri*. However, he pointed out that 'the subspecies of *spinosus* represent extreme variations, and that there are other forms intermediate between the named forms. The existence of these intermediates might justify the synonymizing of the subspecies with the typical form'. Despite this statement the taxonomic system put forward by Smith was reproduced by Creighton (1950) in his useful study of North American ants.

The chief objection to Smith's (1938) system is expressed in the first couplet of his key, where he states:

1 First gastric segment finely punctulate, shagreened, subopaque toward the base . . . 2

– First gastric segment entirely smooth, except for scattered, piligerous punctures . . . 3

Very few samples from different localities need be examined to show that this character is very variable, and Creighton (1950) looked at a case in point, namely some material from the Huachuca Mts of Arizona which he said were 'intergrades between *insons* and *hispidus*'. In reality these specimens were intergrades between *spinosum* and *insons*, which represent a single species showing a fairly good west→east cline along which gastral sculpture decreases in an easterly direction.

Other characters chosen by Smith (and before him by Wheeler, 1915) are equally variable, such as the shape of the metapleural lobes (= metasternal angles) and the degree of development of the metanotal groove. Whilst searching for more stable characters it became apparent that the fauna consisted of a very widespread and variable species, *spinosum* (which was synonymous with *insons* and *wheeleri*), and that within the range of this species were three other valid species which differed consistently in all the available material. Some samples of these other species had been relegated to one or more of the subspecies in collections by reliance upon the older keys, but eventually a system emerged which had four fairly well-defined species which, except for *hispidum*, did not correspond with the older taxonomy.

In the present system *hispidum*, the only survivor of the old subspecies, is raised to the rank of good species, characterized by its combination of large eyes and short, bristly pilosity. The other subspecific names fall as synonyms of *spinosum*, but out of the mass of material formerly assigned here emerge two new Mexican species, *mexicanum* with very long, dense, conspicuous pilosity on body and appendages, and *placidum*, a small species with strongly reduced sculpture.

All of these species show a fair degree of variation and seem to indicate that the *spinosum*-complex is still radiating. Further collections may show up other sibling species in need of definition or, on the other hand, may turn up intermediates between the species here described, which will necessitate another look at the complex.

Tetramorium hispidum (Wheeler) **comb. et stat. n.**

(Figs 50, 51)

Xiphomyrmex spinosus subsp. *hispidus* Wheeler, 1915 : 415. Syntype workers, U.S.A.: Arizona, desert E. of Tucson, 22.xi.1910 (*W. M. Wheeler*) (USNM, Washington; MCZ, Cambridge; BMNH) [examined].

WORKER. TL 3·9–4·5, HL 0·90–1·02, HW 0·84–0·94, CI 89–94, SL 0·68–0·82, SI 81–89, PW 0·64–0·74, AL 1·16–1·38 (30 measured).

Mandibles densely longitudinally striate. Frontal carinae strongly developed, sinuate, surmounted by a semitranslucent raised rim or flange which is highest behind the frontal lobes and gradually becomes lower posteriorly. Antennal scrobes narrow but capable of receiving the scape. Eyes both absolutely and relatively large, their maximum diameter 0·22–0·26, about 0·26–0·30 × HW. Propodeal spines short, stout and acute. Metapleural lobes varying in shape from a short, broad but acute triangle to a rounded–triangular lobe, never elongate–spiniform and often as broad or broader across the base than they are long. Dorsum of head longitudinally rugulose, the constituents spaced out and usually gently sinuate or irregular along their length, but not vermiculate. Reticular cross-meshes sparse or absent in front of the level of the posterior margins of the eyes but the occiput usually with a rugoreticulum. Dorsal alitrunk and petiole coarsely reticulate–rugose, the latter less strongly so than the former. Dorsum of postpetiole less strongly rugose than petiole but with more strongly developed punctulate sculpture between the rugae. Elsewhere dense punctulate sculpture is usually conspicuous on the head between the rugulae but is much weaker on the dorsal alitrunk. First gastral tergite with a basal band of dense punctulation or shagreening which may be faint in some individuals but apparently is never absent in this species. All dorsal surfaces of head and body with dense, short, bristly pilosity, the longest hairs on the alitrunk at most only approaching the maximum diameter of the eye and usually much shorter. Pilosity on leading edge of antennal scapes and dorsal (outer) surface of hind tibiae erect to subdecumbent, very short, less than half the maximum diameter of the appendage from which they arise. Colour varying from reddish yellow to deep red-brown.

Formerly treated as a subspecies of *spinosum*, the above series of diagnostic characters seem consistent and indicate that *hispidum* is best regarded as a valid species. The combination of large eye and short bristly pilosity is not repeated elsewhere in the complex and although some specimens of *spinosum* from Baja California approach *hispidum* in size of eye they have the elongate, less bristly pilosity characteristic of that species.

The punctulation or shagreening of the base of the first gastral tergite seen in this species is variable in density and intensity. In most samples it is coarse and distinct but occasionally it may be so faint as to be visible only under the correct lighting conditions.

MATERIAL EXAMINED.

U.S.A.: Texas, Langtry (*W. M. Wheeler*); Texas, Pesidio Co., Alamito (*W. M. Wheeler*); Arizona, Catalina Mts, Fenner Canyon (*W. M. Wheeler*); Arizona, Cochise Co., Portal (*W. L. Brown*); Arizona, Phoenix (*L. C. Murphree*); Arizona, nr Oracle (*L. G. Werner*); Arizona, Tucson (*W. M. Wheeler*); Arizona, Huachuca Mts, Miller Canyon; Arizona, Mesa (*L. C. Murphree*).

Tetramorium mexicanum **sp. n.**

(Figs 52–54)

HOLOTYPE WORKER. TL 4·9, HL 1·04, HW 0·92, CI 88, SL 0·88, SI 96, PW 0·74, AL 1·38.

Mandibles longitudinally rugulose. Frontal carinae strongly developed to level of posterior margin of eye but behind this rapidly decreasing and becoming indistinguishable from the remaining cephalic sculpture. Antennal scrobes weak, not capable of accommodating the scapes. Antennal scapes long, SI 96 in holotype, with a range of 94–99 in entire type-series (in other members of the complex SI 90 or less). With the head in full-face view the scapes when laid back just exceed the occipital corner. Eyes relatively small, maximum diameter 0·20, about 0·21 × HW. Propodeal spines long, strong and acute; metapleural lobes very elongate-triangular. Outline shape of alitrunk and pedicel as in Fig. 53. Dorsum of head coarsely and irregularly rugose, vermiculate in places, and with numerous cross-meshes, many of which are broken or incomplete. Occiput with a coarse rugoreticulum. Dorsal alitrunk coarsely and sharply rugose, the rugae predominantly longitudinally sinuate or vermiculate but forming a reticulum in places. Petiole and postpetiole similarly but less strongly sculptured. Punctulate ground-sculpture feeble on head and alitrunk dorsally but becoming more distinct on petiole and postpetiole. First gastral tergite unsculptured except for hairpits. Pilosity quite spectacularly developed, with long fine acute hairs abundant on all dorsal surfaces; the longest of those on the pronotum $>1{\cdot}5$ × maximum eye diameter. Leading edge of antennal scapes and dorsal (outer) surfaces of hind tibiae with numerous long hairs, the longest of which distinctly exceed the maximum diameter of the appendage from which they arise. Colour red-brown.

PARATYPE WORKERS. TL 4·8–5·2, HL 1·00–1·12, HW 0·90–1·00, CI 87–90, SL 0·88–0·98, SI 94–99, PW 0·74–0·80, AL 1·36–1·48 (14 measured). As holotype but some lighter in colour, reddish orange, and with the metapleural lobes broader than in the holotype. Metanotal groove variously developed. In holotype visible in profile but in most paratypes not at all impressed. Eyes uniformly small, maximum diameter 0·19–0·21, about 0·20–0·22 × HW. Cephalic sculpture rather more sharply developed in Tepic paratypes than in those from Puerto Los Mazos.

Holotype worker, **Mexico**: Jalisco, Puerto Los Mazos, 10 miles SW. Autlán, 4400 ft, 25.ix.1973, leaf litter forest floor (*A. Newton*) (MCZ, Cambridge).

Paratypes. **Mexico**: 2 workers with same data as holotype; 12 workers, Nayarit, Tepic (*W. M. Mann*) (MCZ, Cambridge; BMNH; LACM, Los Angeles; USNM, Washington).

This large species is characterized by its long antennal scapes, very long dense pilosity, coarse sculpture and small eyes. The first two characters are absolutely diagnostic in available material, the length of the hairs not being approached by any sample of any other species of the complex, and the SI range of 94–99 is higher than in all others, whose combined SI range is 76–90.

Tetramorium placidum sp. n.

(Fig. 46)

HOLOTYPE WORKER. TL 3·4, HL 0·76, HW 0·69, CI 91, SL 0·56, SI 81, PW 0·54, AL 0·92.

Mandibles coarsely longitudinally striate; anterior clypeal margin without a median impression. Frontal carinae feebly sinuate, strongly developed through most of their length but becoming weaker close to the occiput, scarcely more strongly developed than the remaining cephalic rugular sculpture. Antennal scrobes weak. Eyes of moderate size, maximum diameter 0·15, about 0·22 × HW, situated at the mid-length of the sides of the head. Propodeal spines short and stout, basally broad but tapering to an acute and slightly upcurved apex. Metapleural lobes long and very narrowly triangular, about 0·75 × the length of the propodeal spines. Outline shape of alitrunk and pedicel as in Fig. 46. Dorsum of head finely reticulate-rugulose from level of anterior margin of eye to occiput, the reticular cross-meshes only slightly weaker than the longitudinal components. Dorsal alitrunk reticulate-rugose. Ground sculpture of both head and dorsal alitrunk a feeble punctulation, effaced in places, especially between the alitrunkal reticulations. Dorsum of petiole irregularly rugulose, dorsum of postpetiole unsculptured, smooth and polished. First gastral tergite unsculptured except for pits from which hairs arise. Standing fine pilosity abundant on all dorsal surfaces but the leading edges of the antennal scapes and the dorsal (outer) surfaces of the hind tibiae only with short, fine hairs which are subdecumbent to decumbent. Colour reddish brown.

PARATYPE WORKERS. As holotype, with range of dimensions TL 3·3–3·4, HL 0·76–0·78. HW 0·69–0·72, CI 91–92, SL 0·56–0·58, SI 80–84, PW 0·52–0·54, AL 0·90–0·92 (2 measured).

Holotype worker, **Mexico**: Jalisco, Puerto Los Mazos, 10 miles SW. Autlán 4400 ft, 25.ix.1973, leaf litter forest floor (*A. Newton*) (MCZ, Cambridge).

Paratypes. 2 workers with same data as holotype (BMNH; LACM, Los Angeles).

Apart from the type-series a short series in alcohol is present in CAS, San Francisco (determined as *spinosum*). These fit the above description but are lighter in colour (orange-yellow) and somewhat smaller than the types, HL 0·70–0·72, HW 0·66–0·68, CI 94, SL 0·50–0·52, SI 76, PW 0·50–0·52, AL 0·86–0·88 (3 measured). They come from Mexico: Nayarit, San Blas, 17.ix.1953 (*B. Malkin*).

This species is distinguished by its small size and unsculptured postpetiole.

Tetramorium spinosum (Pergande) **comb. n.**

(Fig. 55)

Xiphomyrmex spinosus Pergande, 1896 : 894. LECTOTYPE and three paralectotype workers, MEXICO: Baja California, Sierra San Lazaro, Cape Region (*Eisen & Vaslit*) (USNM, Washington), here designated [examined].

Tetramorium (*Xiphomyrmex*) *wheeleri* Forel, 1901 : 128. Syntype workers, MEXICO: Zacatecas, Pacheco (*W. M. Wheeler*) (MHN, Geneva) [examined]. **Syn. n.**

Xiphomyrmex spinosus subsp. *insons* Wheeler, 1915 : 416. Syntype workers, U.S.A.: Texas, Austin (*W. M. Wheeler*) (MCZ, Cambridge; BMNH) [examined]. **Syn. n.**

WORKER. TL 3·6–5·1, HL 0·84–1·12, HW 0·77–1·04, CI 88–96, SL 0·62–0·88, SI 79–90, PW 0·58–0·82, AL 0·98–1·42 (100 measured).

Mandibles strongly longitudinally striate. Anterior clypeal margin usually with a median impression but this may be very shallow or vestigial in some samples. Frontal carinae strongly developed, running back well beyond the level of the posterior margins of the eyes but towards the occipital corners fading out and blending into the occipital rugoreticulum. Throughout their length the frontal carinae with a raised, semitranslucent ridge which is highest anteriorly and gradually becomes lower posteriorly. Eyes moderate to fairly large, maximum diameter 0·18–0·24, about 0·20–0·25 × HW but with relatively few samples in the upper range. Propodeal spines varying from elongate-triangular to long-spiniform, with all intermediates. Similarly, the metapleural lobes varying from low, broadly triangular structures to elongate spiniform teeth. Dorsum of head longitudinally rugulose, the rugulae irregular or sinuate along their length. Reticular cross-meshes usually present in western samples but tending to be reduced or absent in those from the east, but a rugoreticulum present occipitally in all cases. Dorsal alitrunk rugose, predominantly longitudinally so but with a rugoreticulum present at least on the pronotum; sometimes everywhere reticulate-rugose. Dorsum of petiole and postpetiole irregularly rugose or rugulose, the former more strongly so than the latter. First gastral tergite varying from completely smooth to strongly punctulate basally, with all intermediate phases apparent. Pilosity on all dorsal surfaces of head and body elongate, fine and dense, acute apically; the longest hairs on the dorsal alitrunk longer than the maximum diameter of the eye. Hairs on leading edge of antennal scapes and on dorsal (outer) surfaces of hind tibiae varying from erect to subdecumbent but always shorter than the maximum diameter of the appendage from which they arise. Colour reddish yellow to reddish brown, often with the gaster lighter in shade than the head and alitrunk.

This is the most common, most widely distributed and most variable species of the *spinosum*-complex in North America. Variation in *spinosum* takes the form of a rough double cline, one running from west to east and the other from north to south. Predominant variation on the west–east axis, which runs from Baja California across to Texas, is the reduction of sculpture on the first gastral tergite. In specimens from Baja California the base of the tergite is usually distinctly sculptured, but further east in Arizona it is reduced to fainter markings and in Texan material the gaster is smooth. Exceptions to the trend occur in Jalisco where specimens without gastral sculpture are quite common, but despite this it is now obvious that gastral sculpture is of no use in separating the species of this complex. On the north–south axis the most obvious variation is in the length of the propodeal spines, which start off quite short in Arizona and other northern areas and show an overall gradual increase in length as one moves south, ending up long and narrow in Jalisco and Zacatecas. To a lesser degree the metapleural lobes share in this trend as specimens from Jalisco tend to have them much longer and more definitely spiniform than do specimens from further north where they tend to be more markedly triangular. In some specimens from Arizona the metapleural lobes are low and very broad, approaching the condition seen in *hispidum*.

The above discussion shows trends in variation, but it should be noted that here and there odd samples form exceptions to the rule and other variation, which appears to be sporadic, is also present. This includes the density and degree of elevation of tibial pilosity and intensity of sculpture. The second of these does not appear to have any pattern to it, but the tibial pilosity can be summarized thus: specimens from Texas and Nuevo Leon tend to have numerous fine hairs on the dorsal (outer) tibial surface which are subdecumbent, gently curved along their length and inclined towards the tibial apex. Material from Jalisco, on the other hand, tends to have fewer hairs on the outer tibial surface and those present are generally suberect and straight. In intermediate zones (Arizona to W. Texas) and in Baja California both forms occur as do intergrades between the two extremes.

The three other species of the complex which occur inside the vast range of *spinosum* are best separated from it by reference to characters which the central species does not possess, such as long pilosity and elongate antennal scapes in *mexicanum*, small size and unsculptured postpetiole in *placidum* and large eyes and short stubbly pilosity in *hispidum*.

MATERIAL EXAMINED

U.S.A.: Texas, Austin (*W. M. Wheeler*); Austin (*R. A. Cushman*); Texas, Bulverde (*D. H. Bixby*); Brownsville (*H. S. Barber*); Brownsville (*W. S. Ross*); Bexar Co., Helotes; Texas, Ozona (*A. C. Cole*); Texas, Junction (*S. E. Aldous*); Beeville (*Pergande*); San Diego (*Pergande* ?); Texas, Del Rio (*W. M. Mann*); Bracketville (*M. P. Creighton*); Arizona, Cochise Co., Huachuca Mts, Ash Canyon (*R. R. Snelling*); Carr Canyon (*R. R. Snelling*); Ramsey Canyon (*W. S. Creighton*); Pinaleno Mts, Post Canyon (*W. M. Wheeler*); Santa Cruz Co., Pena Blanca Spring (*Bryan*). **Mexico**: Nuevo Leon, nr Linares (*E. M. & J. L. Fisher*); Sonora, Nogales; Baja California, Los Parras (*R. R. Snelling*); Los Parras (*W. M. Mann*); Baja California, Purissima (*W. M. Mann*); Loreta (*W. M. Mann*); Jalisco, Atenquique (*Dixon & Heyer*); Nevado de Colima (*A. Newton*); S. of Mazamitin (*E. S. Ross*); Jalisco, Cocula (*W. M. Mann*); Cocula, San Diego (*W. M. Mann*); Michoacan, Uruapan (*W. M. Mann*); Nayarit, Tepic, Santiago (*T. Pergande*).

The *bicarinatum*-group

Antennae with 12 segments, sting appendage triangular, dentiform or pennant-shaped. Anterior clypeal margin with a median notch or impression. Median portion of clypeus with three principal longitudinal carinae, often without other sculpture but sometimes with another much weaker pair of carinae. Mandibles variously sculptured, smooth to striate. Frontal carinae strongly developed, reaching back almost or quite to the occipital margin. Propodeal spines always strongly developed, straight to somewhat upcurved along their length. First gastral tergite commonly costulate basally. Basic sculpture throughout the group a strong rugoreticulum. Pilosity usually abundant, elongate and fine; short truncated hairs absent.

This group contains a number of the larger and more conspicuous members of the genus. The Oriental/Indo-Australian region has a total of 13 species and the Ethiopian region about 15.

One species of the group, *bicarinatum*, is a highly successful tramp-species and has been recorded from all over the world except for the Ethiopian region. Two other members of the group have some tramping ability, *insolens* and *pacificum*. The former closely resembles *bicarinatum* and has been found to date in Britain, Germany and the U.S.A., but always as an introduction or living in zoological or botanical gardens. The latter occurs sporadically in California where it has been recorded by M. R. Smith (1943) and Creighton (1950). The species has an enormous range in the Indo-Australian and Oriental regions and seems to be present on most of the Pacific island-systems, so it is hardly surprising that it should occur occasionally on the west coast of the United States.

Tetramorium bicarinatum (Nylander)

(Figs 39, 43, 47)

Myrmica bicarinata Nylander, 1846 : 1061. Syntype workers, female, U.S.A.: California, 1840 (types lost).

Tetramorium bicarinatum (Nylander); Mayr, 1862 : 740. [For a full statement of the current synonymy of *bicarinatum*, application of the name and discussion of the species see Bolton, 1977 : 94.]

WORKER. TL 3·4–4·5, HL 0·80–1·00, HW 0·68–0·86, CI 80–87, SL 0·54–0·68, SI 75–84, PW 0·50–0·62, AL 0·94–1·20 (114 measured).

Mandibles very finely and densely longitudinally striate; extremely rarely the mandibles appearing finely shagreened. Anterior clypeal margin with a marked median notch or impression. Median portion of clypeus with three longitudinal carinae of about equal strength, a median and one on each side. Sometimes another carina present on each side of the median but these are very feeble by comparison and nearly always incomplete or broken. Frontal carinae strong, running back almost to the occiput and equipped above with a narrow, raised semitranslucent rim or flange. Eyes relatively large, maximum diameter *c.* 0·19–0·24 so that diameter of eye is 0·26–0·29 × HW. Pronotal angles sharp in dorsal view. Metanotal groove absent but some specimens with a shallow impression in the alitrunk outline at its approximate position. Propodeal spines in profile strong and acute, moderately long, varying from more or less straight to slightly upcurved along their length. Metapleural lobes elongate-triangular and upcurved. Petiole node in profile roughly rectangular, with parallel or almost parallel anterior and posterior faces and an evenly convex dorsum which meets each face in an angle. The anterodorsal and posterodorsal angles of the node in profile are on a level as the dorsum of the node does not slope upward posteriorly. Dorsum of head with scattered irregular longitudinal rugae with a few cross-meshes but behind the level of the eyes with a strong rugoreticulum (Fig. 47). Ground-sculpture between the rugae superficial and inconspicuous. Dorsum of alitrunk, petiole and postpetiole reticulate-rugose, the sides of the pedicel segments similarly sculptured. Gaster unsculptured for the most part but nearly always with some short, fine, basal costulae on the first tergite. These may be very faint but are only rarely completely absent. All dorsal surfaces with numerous erect or suberect hairs, those projecting from the dorsum of the frontal carinae between the antennal insertions and the occipital corner relatively short (by comparison with other species of the group), shorter than the maximum diameter of the eye. Head, alitrunk, petiole and postpetiole varying from light yellow-brown to bright orange-yellow, the gaster always much darker, deep brown or blackish brown.

T. bicarinatum is a highly successful tramp species which appears to have originated in SE Asia. It is now reasonably common throughout the tropical and subtropical zones of the world except for the Ethiopian region, from which it is unknown. In temperate zones *bicarinatum* is capable of establishing itself in hothouses, conservatories and other constantly heated buildings.

It is the only member of its group to be found in Madagascar, but in the New World two closely related species also occur as introductions. These are *pacificum* and *insolens*, both of which differ from *bicarinatum* in having the mandibles smooth and shining. In addition to this, the petiole node is very differently shaped in *pacificum* (compare Figs 43 and 44) and the ant is uniformly dark brown or black in colour. *T. insolens* also differs in colour from *bicarinatum*, having the gaster the same colour or lighter than the head and alitrunk, and in addition having relatively much longer hairs on the dorsum of the frontal carinae, which are distinctly longer than the maximum diameter of the eye (compare Figs 39 and 40).

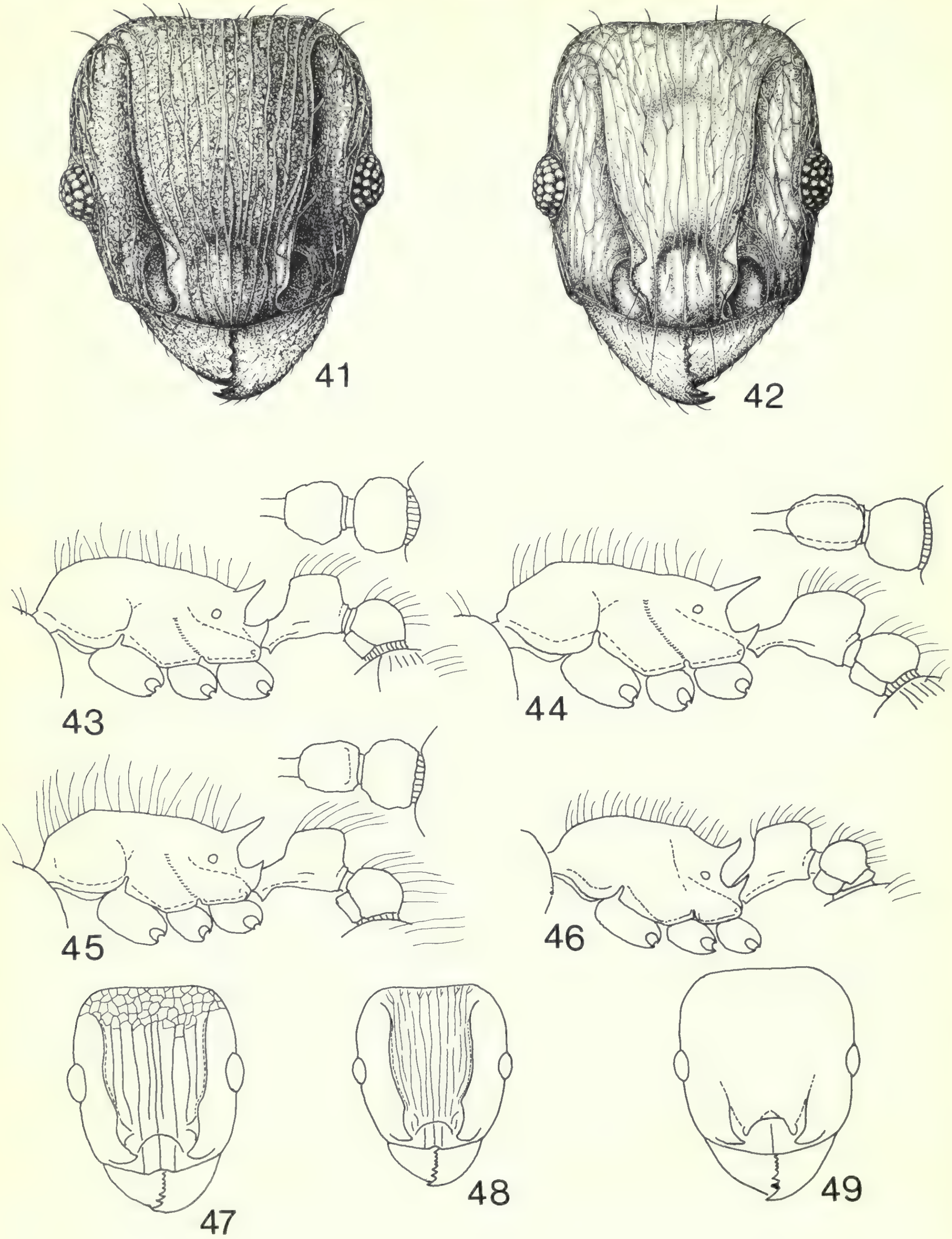
For a full list of material previously examined see Bolton (1977 : 96). In this study I have examined material of the Neotropical region from Mexico, Trinidad, Cuba, Puerto Rico, Antigua, Dominican Republic, Barbados, Haiti, Panama, Costa Rica, Honduras, Nicaragua, Venezuela, Colombia, Bolivia, Guiana, Brazil and Peru, which indicates that *bicarinatum* is fairly well established in the neotropics. Material from North America has been seen from the Bahamas, Florida, New York, Ohio, Wisconsin, Illinois, Georgia, Texas, W. Virginia, California. The majority of this material is deposited in USNM, Washington; MCZ, Cambridge; LACM, Los Angeles; BMNH.

Tetramorium insolens (F. Smith)
(Figs 40, 45)

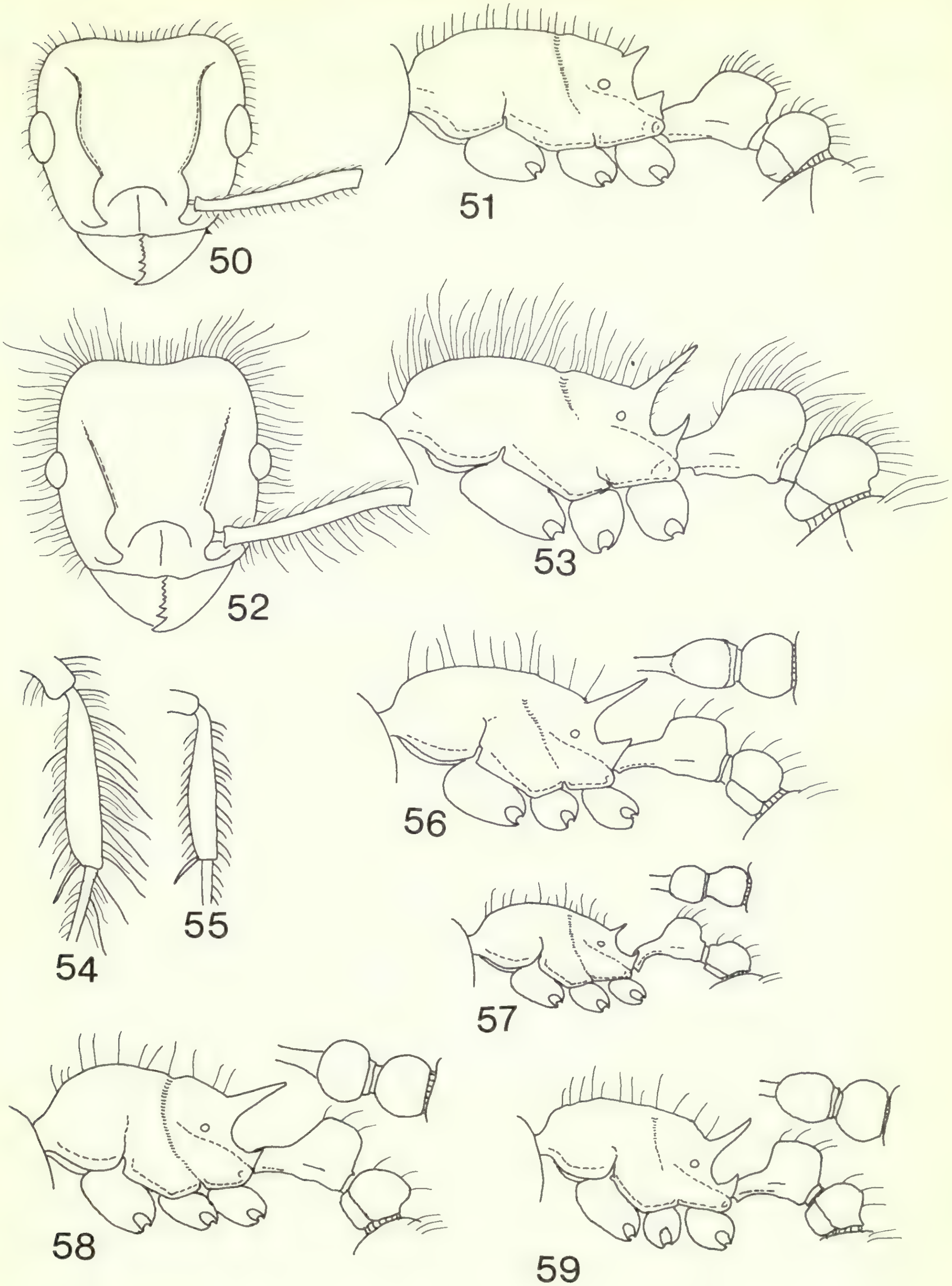
Myrmica insolens F. Smith, 1861 : 47. Holotype female, SULAWESI: Menado (*A. R. Wallace*) (UM, Oxford) [examined].

Tetramorium insolens (F. Smith); Donisthorpe, 1932 : 468. [For a full statement of current synonymy of *insolens* see Bolton, 1977: 99 with the exception of *melanogyna* Mann, for which see p. 173, this paper.]

WORKER. TL 3·3–4·0, HL 0·78–0·94, HW 0·68–0·84, CI 84–88, SL 0·56–0·68, SI 78–86, PW 0·50–0·62, AL 0·92–1·08 (40 measured).



Figs 41–49 *Tetramorium* workers. Head or alitrunk of (41) *simillimum*, (42) *caldarium*, (43) *bicarinatum*, (44) *pacificum*, (45) *insolens*, (46) *placidum*, (47) *bicarinatum*, (48) *lucayanum*, (49) *caespitum*. Pilosity omitted in Figs 47–49.



Figs 50–59 *Tetramorium* workers. Head and alitrunk of (50, 51) *hispidum*, (52, 53) *mexicanum*. 54–55. Hind tibia of (54) *mexicanum*, (55) *spinosum* to show pilosity. 56–59. Alitrunk of (56) *palaense*, (57) *ocothrum*, (58) *rekhefe*, (59) *belgaense*. Fringing pilosity only indicated in Figs 50 and 52.

Mandibles smooth and shining, unsculptured except for scattered pits. Anterior clypeal margin with a median notch or impression; median portion of clypeus with three strong longitudinal carinae. Frontal carinae long and strong, extending back almost to occiput. Eyes of moderate size, maximum diameter *c.* 0·18–0·20, about 0·23–0·26 × HW. Pronotal corners in dorsal view angular. Propodeal spines long and stout, generally somewhat upcurved along their length, more rarely with the extreme apex of each spine suddenly upcurved. Metapleural lobes triangular, acute, somewhat upcurved. Petiole node in profile with anterior and posterior faces approximately parallel, the dorsum convex and rising slightly posteriorly so that the anterodorsal angle is on a slightly lower level than the posterodorsal, the latter angle usually sharper than the former, which has a tendency to be rounded. Dorsum of head to level of eyes with sparse longitudinal rugulae with a few cross-meshes and a fine but fairly conspicuous ground-sculpture. Behind the level of the eyes the head is reticulate-rugose. Dorsal alitrunk with an irregular rugoreticulum which is usually strongest on the pronotum. Petiole and postpetiole reticulate-rugose both laterally and dorsally. Gaster unsculptured. All dorsal surfaces of head and body with abundant long erect or suberect hairs, those situated in a row on the upper surfaces of the frontal carinae between antennal insertion and occiput very long, distinctly longer than the maximum diameter of the eye. Colour varying from clear pale yellow to light orange-brown, usually with the gaster distinctly lighter in shade than the head and alitrunk. More rarely the ant is uniformly coloured.

The differences between this species and the closely related *bicarinatum* were tabulated in part 2 (Bolton, 1977) of this study. Basically, *insolens* differs from *bicarinatum* in having smooth mandibles, relatively long hairs on the frontal carinae (longer than maximum diameter of eye), gaster not darker in colour than alitrunk and the petiole a slightly different shape (compare Figs 43 and 45).

As a tramp-species *insolens* is by no means as successful as *bicarinatum*. It has a very wide range in the Pacific island-systems and is known from Indonesia, Philippines and the Solomon Islands. It was collected by E. O. Wilson in Sri Lanka, where it may be an introduction, and in England (in orchid house), Germany (zoological garden) and in the U.S.A. (near Los Angeles) where it is most certainly introduced. The Los Angeles specimens are deposited in USNM, Washington; for other localities see Bolton (1977).

Tetramorium pacificum Mayr

(Fig. 44)

Tetramorium pacificum Mayr, 1870 : 972, 976. Syntype workers, female, TONGA: Tongatabu (BMNH; NM, Vienna) [examined]. [For a statement of current synonymy of *pacificum* see Bolton, 1977 : 102.]

WORKER. TL 3·7–4·6, HL 0·86–1·10, HW 0·72–1·02, CI 83–90, SL 0·62–0·82, SI 79–87, PW 0·54–0·68, AL 1·04–1·30 (45 measured).

Mandibles usually unsculptured except for hair-pits but in some populations with feeble traces of striation. Anterior clypeal margin with a median notch or impression; median portion of clypeus with three strong longitudinal carinae. Frontal carinae long and strongly developed, usually approaching the occipital margin. Maximum diameter of eye *c.* 0·18–0·21, about 0·22–0·25 × HW. Propodeal spines long and acute, usually narrow and often somewhat upcurved along their length. Metapleural lobes acute and upcurved, usually broad. Petiole in profile characteristically shaped (Fig. 44), with the posterior face higher than the anterior so that the convex dorsum slopes upwards posteriorly and the posterodorsal angle is higher than the anterodorsal. Anterior face and dorsum confluent through a curve. Sculpture variable in density and intensity. On the head varying from a blanketing rugoreticulum to a system which is predominantly longitudinal but with cross-meshes present from the level of the anterior margins of the eyes; always with a reticulum posteriorly, close to the occiput. Ground-sculpture between rugae superficial but quite conspicuous. Dorsal alitrunk reticulate-rugose; often pedicel segments similarly sculptured but in some the sculpture predominantly longitudinal. First gastral tergite usually with at least traces of basal costulae; although these are often vestigial they are only rarely completely absent. Erect or suberect long hairs numerous on all dorsal surfaces of head and body. Colour a uniform dark brown, blackish brown or black.

T. pacificum ranges throughout the Oriental and Indo-Australian regions and occurs in northern Australia. It is very widespread in most or all of the island-systems of the Pacific (Wilson & Taylor, 1967; Bolton, 1977) and has been recorded from California in the U.S.A. (M. R. Smith, 1943; Creighton, 1950). The shape of the petiole in *pacificum* is unique amongst tetramoriines occurring in the New World and should serve to identify instantly this species.

The *simillimum*-group

Antenna with 12 segments. Sting appendage triangular or dentiform. Mandibles usually sculptured with striation or shagreening, rarely smooth. Anterior clypeal margin entire, without a median notch or impression. Frontal carinae variable, ranging from strong to vestigial but only rarely completely absent. Scrobes with all grades from absent to strong. Antennal scapes with SI$<$100. Propodeum armed usually with a pair of teeth or tubercles, never with spines, unarmed in one species; the propodeal teeth at most only as long as the metapleural lobes. Middle and hind tibiae without standing hairs of any description but usually with sparse appressed pubescence. Body hairs sparse, all dorsal surfaces with short, stout, blunt hairs, without fine or acute pilosity. Petiole narrowly nodiform in profile, in dorsal view usually as broad as or broader than long. Small to minute species, usually yellow or yellowish brown in colour, rarely otherwise.

This group is based on the Ethiopian region where about 15 species are present. Five species occur in Madagascar, two of which are endemic (p. 155) and one of which is shared with the Ethiopian region. The remaining two species are efficient tramp-forms of African origin which also occur in the New World, and are dealt with here.

Of the two there is no doubt that *simillimum* is the most successful. It has been widely recorded throughout the tropics and subtropics and also occurs fairly frequently in the temperate zones in zoological and botanical gardens and in conservatories and other constantly heated buildings.

Tetramorium caldarium (Roger) **stat. rev.**

(Figs 28, 42)

Tetrogmus caldarius Roger, 1857 : 12. Syntype worker, GERMANY: Prussia, 'Ananashause in Rauden' (BMNH) [examined] (previously treated as a synonym of *simillimum*, see note below).

Tetramorium pusillum var. *hemisi* Wheeler, 1922 : 193. Syntype workers, ZAIRE: Niangara, stomach of frog (*Hemisus marmoratum*) (*H. O. Lang*) (MCZ, Cambridge) [examined]. **Syn. n.**

Tetramorium antipodum Wheeler, 1927 : 143. Syntype workers, NORFOLK I.: 1915 (*A. M. Lea*) (MCZ, Cambridge) [examined]. **Syn. n.**

Tetramorium minutum Donisthorpe, 1942 : 30. Holotype female, EGYPT: Siwa, 17.vii.1935 (*J. Omer-Cooper*) (BMNH) [examined]. **Syn. n.**

Note. Roger (1862 : 297) synonymized his species *Tetrogmus caldarius* with *Tetramorium simillimum*, the latter being the senior name. His genus *Tetrogmus* rightly disappeared into the synonymy of *Tetramorium* but since then the name of the species which he described has consistently been referred to the synonymy of *simillimum*, where I left it in the second part of this study (Bolton, 1977). Since then the taxonomy of the *simillimum*-group has been studied in greater detail and it has become apparent that *caldarium* is a valid species, close to *simillimum* but consistently differing from it in the structure of the frontal carinae and in other details. From this finding *T. caldarium* is henceforth removed from the synonymy of *simillimum* and stands as a good species.

WORKER. Basically similar to *simillimum* and agreeing with the description of that species in most particulars, but differing as follows.

1. *Frontal carinae less strongly developed.* Generally the frontal carinae of *caldarium* are feeble throughout their length and usually weakly or not sinuate. They are best developed to the level of the midlength of the eye, behind which they become weak or broken, or fade out posteriorly, becoming indistinguishable from the cephalic rugulae in many cases. The low, raised flange or rim, which runs almost the length of the carinae in *simillimum*, is much weaker in *caldarium* and only developed to a level about equal to the midlength of the eye, behind which it quickly disappears.
2. *Antennal scrobes feeble.* In *simillimum* the antennal scrobes are shallow but are long and broad and distinctly concave, the effect being enhanced by the strong frontal carinae which delimit their dorsal and posterior margins. In *caldarium* the scrobes are much more weakly developed, very little concave and not bordered posteriorly. Also, the poor development of the frontal carinae makes the scrobes look very nondescript. Compare Figs 41 and 42.

3. *Cephalic ground sculpture weak.* In *caldarium* the strong reticulate-punctulation or granulation seen in *simillimum* is replaced by a much weaker granular or punctulate ground-sculpture between the rugulae, so that the head appears by no means as matt and rough.
4. *Head differently shaped.* In *simillimum* the head in full-face view tends to become broader from front to back, the sides diverging behind the level of the eyes, whereas in *caldarium* the width of the head does not noticeably increase posteriorly, compare Figs 41 and 42.

These characters in combination will differentiate the two species in the New World. The species will be treated in more detail in the part of this study dealing with the fauna of the Ethiopian region, as both have a number of closely related forms in that zoogeographical region.

Apart from the New World references given below, *caldarium* is widely distributed in Africa from Egypt to Kenya and occurs sporadically on islands such as the Cape Verde group, Mauritius, Madeira and St Helena. Occasionally it is introduced in Europe as the types from Germany and a series from Kew Gardens, London go to show, but it is hard to assess how often it is introduced or how successful the species is as no doubt many of the past identifications of *simillimum* in Europe should in fact have been referred to this species. *T. caldarium* is not known from Australia and seems to be uncommon throughout the Oriental and Indo-Australian regions. Three series are known from India but apart from this the only records of *caldarium* are the series from Norfolk Island which make up the types of the synonymous *antipodum* and three workers from New Caledonia.

In part two of this survey (Bolton, 1977 : 131) I gave *antipodum* as a provisional synonym of *simillimum* as at that time I had not been able to locate any members of the type-series. Since then a number of specimens referable to the type-series of *antipodum* have been found in the collections of MCZ, Cambridge and these show the species to be a straight synonym of *caldarium*.

MATERIAL EXAMINED (New World)

U.S.A.: Florida, St Augustine (*W. L. Brown*). **Mexico**: Rio Metlac, Veracruz Canyon (*A. Newton*); Nogales; Guerrero, Chilpancingo (*N. L. H. Krauss*). **Puerto Rico**: Mayaguez (*M. R. Smith*); Tres Hermanos (*M. R. Smith*); Coamo Springs (*W. M. Wheeler*). **Haiti**: Furcy (*W. M. Mann*). **Dominican Republic**: series on logs ex Dominica, intercepted at New York. **Colombia**: series on orchids ex Colombia, intercepted at New York (*S. D. Whittock*). **Brazil**: SP., Paracicaba (*C. A. Triplehorn*). **Peru**: Chaclacayo, E. Lima (*H. Crozier*).

Tetramorium simillimum (F. Smith)

(Figs 38, 41)

Myrmica simillima F. Smith, 1851 : 118. Syntype workers, GREAT BRITAIN: England, Dorset (types lost).
Tetramorium simillimum (F. Smith); Mayr, 1861 : 15, 61. [For a statement of current synonymy see Bolton, 1977 : 131 with the exception of *caldarium* (Roger), for which see above.]

WORKER. TL 2·1–2·5, HL 0·54–0·60, HW 0·48–0·54, CI 88–93, SL 0·36–0·42, SI 74–80, PW 0·34–0·40, AL 0·58–0·68 (45 measured).

Mandibles feebly striate or weakly shagreened, never strongly rugulose, rarely with sculpture almost effaced. Anterior clypeal margin convex and entire, without a median notch or impression. Frontal carinae strongly developed, weakly sinuate, extending back almost to the occiput and outcurved posteriorly, fading out around the posterior borders of the broad but shallow antennal scrobes. Eyes moderate in size, their maximum diameter 0·22–0·26 × HW. Occiptial margin of head in full-face view broadly but shallowly concave, the sides of the head broadened behind the eyes, weakly convex, merging into the evenly rounded occipital corners. Propodeum armed with a pair of short, triangular teeth which are usually shorter than the metapleural lobes, the latter broad and roughly triangular in shape. Petiole in profile as in Fig. 38, the node in dorsal view always slightly broader than long, somewhat variable in shape but always broadening posteriorly before narrowing to the postpetiolar junction. Dorsum of head finely longitudinally rugulose, the spaces between the rugulae packed with a fine, dense conspicuous reticulate-punctulation or granulation. Dorsal alitrunk finely, often faintly longitudinally rugulose, the spaces between rugulae densely punctulate. Dorsal petiole and postpetiole similarly but less strongly sculptured, the sculpture sometimes reduced but never completely absent. Gaster unsculptured or with faint granulation on base of first tergite. All dorsal surfaces of head and body with scattered short hairs, generally longer on the gaster then elsewhere. Hairs on alitrunk conspicuous, short, stout and blunt.

Antennal scapes and tibiae only with very short, fine pubescence which is appressed. Colour yellow to yellow brown, often with the gaster darker than the head and alitrunk but some populations uniformly coloured.

MATERIAL EXAMINED (New World)

U.S.A.: Florida, Orlando (*O. C. McBride*); Florida, Bradenton (*G. D. Reynolds*); Florida, Ft Ogden (*D. E. Read*); Florida, Ft Myers (*W. M. Barrows*); California, San Francisco (no further data). **Mexico**: Cordoba (*Mann & Skewes*); Cordoba (*Silvestri*); Chiapes, Ocosingo (*R. L. Dressler*). **Guatemala**: Los Amatea (*Kellerman*). **Bahamas**: Andros I. (*W. M. Wheeler*), Egg I. (*Wickham*). **Virgin Is.**: St Croix (*H. Morrison*). **Cuba**: Cristo (*W. M. Mann*); Soledad, Cienfuegos (*N. A. Weber*); Soledad, Atkins Gdns (*E. O. Wilson*). **Jamaica**: series without data; Balaclava (*W. M. Wheeler*). **Haiti**: Mts N. of Jacmel (*W. M. Mann*); Mannerville (*W. M. Mann*); Grande Riviere (*W. M. Mann*); Diquini (*W. M. Mann*). **Trinidad**: Curepe (*J. Noyes*); series ex Trinidad on palms, intercepted Philadelphia (*W. Chapman*). **Venezuela:** Caracas (*N. Perrine*); Orinoco Delta (*N. A. Weber*); P. Anduz, Moitaco. **Brazil:** Bahia (*H. L. Sumford*); S. P., San Sebastiao (*B. Fledderman*) Manaus (*Mann & Baker*). **Peru**: series ex Peru on orchids, intercepted Miami, Florida.

The *caespitum*-group

Antennae with 12 segments, sting appendage triangular to dentiform. Anterior clypeal margin entire, without a median notch or impression. Frontal carinae short, sometimes virtually absent, never extending back as far as posterior margins of eyes and generally much shorter. Antennal scrobes absent. Metanotal groove almost always impressed in profile, even if only weakly so. Propodeal spines short, usually reduced to a pair of triangular teeth, sometimes reduced to tubercles. Nodes of both petiole and postpetiole in dorsal view at least as broad as long, usually distinctly broader than long. Scapes and hind tibiae dorsally without long, erect or suberect hairs but often with suberect or subdecumbent-appressed pubescence. Dorsal surfaces of alitrunk, pedicel segments and gaster with elongate fine hairs at least in part, never with all hairs short, stout and blunt. Sculpture of head of fine, regular longitudinal rugulation or reduced, in some species the head virtually unsculptured.

This is the dominant and only endemic group of *Tetramorium* in the Palaearctic region. One species, *caespitum*, has been introduced into North America (M. R. Smith, 1943; Brown, 1957) and it is now well established in the U.S.A. with a wide range on that continent (Creighton, 1950).

The taxonomy of the *caespitum*-group is in a very poor state, with over 100 names, the majority described as infraspecific or infrasubspecific forms of *caespitum* itself and many of the names based on meaningless characters or represented by descriptions which can only be called valueless. Because of this a formal description of *caespitum* is not given here, but the species as it occurs in North America should be easily recognizable from the following summary as it is the only member of its group established on that continent.

Tetramorium caespitum (L.)

(Figs 37, 49)

Formica caespitum L., 1758 : 581. Holotype female, EUROPE ('in Europae tuberibus') (holotype not in Linnean Society collection, London).

Tetramorium caespitum (L.); Mayr, 1855 : 426.

Tetramorium caespitum var. *immigrans* Santschi, 1927 : 54. Syntype workers, CHILE: Valparaiso (*Miss Edwards*) (probably in NM, Basle; not seen). **Syn. n.**

Myrmica (*Myrmica*) *brevinodis* var. *transversinodis* Enzmann, 1946 : 47, figs 1, 2. Holotype worker, U.S.A.: Massachusetts, Dedham (in private coll. J. Enzmann; not seen). [Synonymy by Brown, 1949 : 47; also Creighton, 1950 : 291.]

WORKER. With the group characters given above; the head densely and finely longitudinally rugulose everywhere. Spaces between rugulae with feeble ground sculpture, mostly shining. Head without unsculptured patches, without reticular or rugoreticular sculpture. Dorsal alitrunk longitudinally rugulose but on the posterior portion of the propodeal dorsum the rugulae being replaced by fine reticulate-punctate sculpture. Dorsal surfaces of petiole and postpetiole finely sculptured but each with a smooth median area or smooth median longitudinal strip. First gastral tergite unsculptured. Metanotal groove impressed in profile, the propodeal spines usually slightly longer than their basal width, but sometimes represented only by a pair of broadly triangular teeth. Pubescence of hind tibiae short and fine, decumbent to appressed.

During this study I have examined specimens from Massachusetts, New York and Pennsylvania, all falling within the range given by Creighton (1950). The var. *transversinodis* of Enzmann, noted above, is accepted as an absolute synonym of *caespitum* without question for, although I have not seen the holotype, the figures and description fit the species very well.

The status of var. *immigrans* is a little more dubious. It was first recorded from Chile by Santschi (1922) as *T. caespitum* but later he described it as *caespitum* var. *immigrans* (1927), both records being based on the same specimens from Valparaiso. Snelling & Hunt (1975) in their review of the Chilean ant fauna note the 1922 record but state that they had seen no material in their survey. Under these circumstances I think it best to assume that the Chilean record represents a casual introduction and to refer *immigrans* to the synonymy of *caespitum*. Sporadic introductions of *caespitum* in the neotropics are probably uncommon but I have seen material originating in Belize and Mexico during the course of this investigation.

The ***camerunense***-group

Antennae with 12 segments. Sting appendage dentiform to pennant-shaped. Mandibles usually smooth but delicately striate in some species. Anterior clypeal margin with a small median notch or impression. Frontal carinae reaching back almost to occiput but not strongly developed. Antennal scrobes feebly developed. Head in full-face view not rectangular, usually with sides slightly but evenly convex and narrowing in front of the eyes. Propodeum strongly bispinose. All dorsal surfaces with numerous long, standing hairs, but scapes and hind tibiae only with short decumbent or appressed pubescence. Petiole nodiform in profile. Sculpture of dorsum of head of fine, longitudinal, roughly parallel rugulae, without a coarse rugoreticulum.

The *camerunense*-group is based upon West and Central Africa, where about 13 species are known. One species of the group, *lucayanum*, was described from the Bahamas and Brown (1957) voiced the opinion that the species was probably of African origin. Later Brown (1964*a*) proved this to be the case when he found specimens from the Ivory Coast, Liberia and Zaire (type of *waelbroeki*) which matched up with material of *lucayanum* from Jamaica.

At present the known New World distribution includes Cuba, Puerto Rico, Jamaica, Virgin Islands and Bahamas (type-locality) as recorded by Brown (1964*a*); and in Africa it occurs in Sierra Leone, Liberia, Ivory Coast, Ghana, Nigeria, Fernando Po I. and Zaire.

Tetramorium lucayanum Wheeler

(Figs 36, 48)

Tetramorium lucayanum Wheeler, 1905 : 100, fig. L. Syntype workers, BAHAMAS: N.P., Nassau, Queen's Staircase (*W. M. Wheeler*) (AMNH, New York) [examined].

Tetramorium camerunense var. *waelbroeki* Forel, 1909 : 53. Holotype worker, ZAIRE: Kinchassa (= Kinshasha) (NM, Basle) [examined]. [Synonymy by Brown, 1964*a* : 131.]

Tetramorium lucayanum var. *sexdens* Forel, 1915 : 357. Syntype workers, IRELAND: Dublin, in greenhouse (MNH, Geneva; BMNH) [examined]. [Synonymy by Brown, 1964*a* : 131.]

Tetramorium rectinodis Menozzi, 1942 : 176, fig. 2B. Syntype workers, FERNANDO PO: Musola, 9.ix.39; San Carlos, x.39 (*H. Eidmann*) (types presumed lost, not in Menozzi coll. at IE, Bologna). [This species also described as new by Menozzi, 1944 : 454. Provisional synonymy of Brown, 1964*a* : 131, here confirmed.]

WORKER. TL 2·8–3·2, HL 0·72–0·80, HW 0·64–0·71, CI 86–91, SL 0·54–0·61, SI 82–87. PW 0·46–0·53, AL 0·80–0·92 (30 measured).

Mandibles usually very feebly longitudinally striate but almost smooth in some populations. Anterior clypeal margin with a weak median impression or notch. Frontal carinae extending back almost to the occiput, forming the dorsal margins of the shallow and broad antennal scrobes. Outline shape of alitrunk and pedicel segments as in Fig. 36. Propodeum armed with a pair of elongate straight spines, the metapleural lobes elongate-triangular and acute, usually upcurved but less commonly almost straight. Petiole in profile with the node ascending vertically from the peduncle, the anterior and dorsal faces meeting in a sharp right-angle. The posterodorsal angle of the node is distinctly more rounded than this. In dorsal view the petiole node with a low but sharp carina traversing the anterior face, the node longer than broad even if only slightly so. Dorsum of head with well spaced out, sharply defined longitudinal rugulae without any cross-meshes and without trace of a rugo-reticulum occipitally, the spaces between the rugulae virtually smooth, with only the faintest traces of ground sculpture. Dorsal alitrunk similarly but less regularly sculptured, sometimes with a few weak cross-meshes, at least on the mesonotum. Petiole dorsum irregularly and quite strongly rugulose, distinctly more strongly sculptured than the postpetiole which has only scattered weak longitudinal rugulae dorsally. Gaster unsculptured. All dorsal surfaces of head and body with numerous standing hairs; antennal scapes and tibiae without such hairs, only with fine dense pubescence. Colour uniform mid-brown to black, the appendages usually somewhat lighter in shade than the body.

MATERIAL EXAMINED (New World)

Bahamas: Nassau (*W. M. Mann*). **Virgin Is.**: St Croix (*W. F. Buren*). **Puerto Rico**: Mayaguez (*M. R. Smith*). **Jamaica**: Kingston (*W. M. Wheeler*). **Cuba**: Cienfuegos (*W. M. Wheeler*); Guantanamo (*W. M. Mann*); Cristo (*W. M. Mann*); Oriente, Yateras Dist. (*W. M. Mann*).

Additions and corrections to previous parts (Bolton, 1976; 1977) of this study

Rhoptromyrmex mayri Forel

Rhoptromyrmex mayri Forel, 1912: 57. Syntype females, INDIA: Poona (*Wroughton*) (BMNH) [examined].
Hagioxenus mayri (Forel); Brown, 1964*b* : 19.

Brown (1964*b*) indicated that this species was not a member of *Rhoptromyrmex* and proposed that it be transferred to genus *Hagioxenus* Forel, where it was left in the first part of this study (Bolton, 1976). Since then I have found four syntype females in the BMNH collection and dissection of two of them has shown that *mayri* is in fact correctly placed in *Rhoptromyrmex*, to which genus it is now formally returned.

The only *Rhoptromyrmex* species known from workers in India is *R. wroughtonii* Forel, and strangely the female of this species has not yet been discovered. It is tempting to assume that *mayri* represents the unknown female of *wroughtonii* but the differences between worker and queen seem greater than can be accounted for by the presumed parasitic lifeway of the females of this genus. In particular the pilosity in the queens representing *mayri* is much more dense and conspicuous than in *wroughtonii* workers, with spectacularly long hairs arising all over the legs and antennal scapes, which are absent from *wroughtonii* workers. On its own this character may not be significant but I think it best to leave the two separate until queen-associated samples of *wroughtonii* are forthcoming.

Tetramorium melanogyna Mann **sp. rev.**

Tetramorium melanogyna Mann, 1919 : 345, fig. 28. Syntype workers, female, SOLOMON Is.: Ugi, Pawa, 1916 (*W. M. Mann*) and Three Sisters, Malapaina, 1916 (*W. M. Mann*) (MCZ, Cambridge; USNM, Washington) [examined].
Tetramorium melanogyna Mann; Bolton, 1977 : 99 [as synonym of *T. insolens* (F. Smith)].

A critical reappraisal of the material of *melanogyna* presently available for study has convinced me that I was mistaken in synonymizing this species with the much more widespread *T. insolens*, and I hereby reverse that decision, restoring *melanogyna* to its original status as a good species.

As far as is known *melanogyna* is restricted to the Solomon Islands and thus it is only specimens from here which may be confused with *insolens*, which also occurs on these islands. Samples of *melanogyna* workers will key out at *insolens* in Bolton (1977), but the two may be distinguished as follows.

insolens	*melanogyna*
Gaster lighter in shade than head and alitrunk.	Gaster darker in shade than head and alitrunk, or at least with an infuscated transverse band.
Hairs on dorsal (outer) surface of hind tibiae suberect to subdecumbent.	Hairs on dorsal (outer) surface of hind tibiae decumbent to appressed.
Rugoreticulum on postpetiole dorsum very strong, as well developed as on pronotum.	Rugoreticulum on postpetiole dorsum weak, more feebly developed than on pronotum.
In a majority of workers the rugose sculpturing of the alitrunk forming a transverse ridge at promesonotal junction.	Rugose sculpturing of alitrunk not forming a transverse ridge at promesonotal junction.

The queens of the two species are easily distinguished as in *insolens* the female has the same colouring as the workers, whilst in *melanogyna* the queen is uniform dark brown. Other names given as synonyms of *insolens* in Bolton (1977 : 99) remain as such.

Correction to key. In the key to *Tetramorium* of the Oriental and Indo-Australian regions (Bolton, 1977 : 72), the second half of couplet 13 should read, 'Dorsum of postpetiole unsculptured . . .', not 'Dorsum of petiole' as is printed. This brings it in line with the first half of the couplet.

Tetramorium belgaense Forel

(Fig. 59)

Tetramorium (*Xiphomyrmex*) *belgaense* Forel, 1902 : 238. Holotype female, India: Mysore, Belgaum (*Wroughton*) (MHN, Geneva) [examined].

Worker (previously undescribed). TL 3·3–4·0, HL 0·74–0·80, HW 0·66–0·70, CI 87–89, SL 0·58–0·64, SI 88–92, PW 0·52–0·58, AL 0·90–1·00 (10 measured).

Antennae with 11 segments. Mandibles finely longitudinally striate. Anterior clypeal margin entire, without a median notch or impression. Frontal carinae long, reaching back almost to occiput and distinctly more strongly developed than other cephalic sculpture. Eyes relatively large, maximum diameter 0·19–0·21, about 0·28–0·30 × HW. Alitrunk in profile with the dorsum evenly convex, the propodeal spines long and narrow, feebly upcurved along their length, twice as long as the acutely triangular metapleural lobes. Petiole in profile with a roughly rectangular node, the anterior face vertical and meeting the shallowly convex dorsum in a blunt right-angle. Posterodorsal angle of node distinctly more rounded than antero-dorsal. Postpetiole in profile high and narrow, the tergum higher than long. Dorsum of head with widely spaced sharp longitudinal rugae with sparse cross-meshes which are less strongly developed and with a narrow reticulum occipitally. Dorsal alitrunk reticulate-rugose, the petiole dorsum similarly but less strongly sculptured. Postpetiole dorsally with a median strip which is punctulate or unsculptured but this is flanked on each side by rugulose sculpture. Gaster unsculptured. All dorsal surfaces of head and body with numerous elongate erect hairs but the scapes and outer tibial surfaces only with fine pubescence. Colour light brown, the appendages yellow, the gaster darker than the head and alitrunk.

In the key to species (Bolton, 1977 : 72) *belgaense* will run out at couplet 12 along with *yerburyi* Forel. The two are immediately separable as the Sri Lankan *yerburyi* is much larger (HW 0·94–1·04, PW 0·70–0·74) with relatively longer antennal scapes (SI 98–102). Apart from these mensurable characters *yerburyi* has long stout hairs projecting from the dorsal (outer) surface of the hind tibiae where only short pubescence is present in *belgaense*, and in *yerburyi* the metapleural lobes are low and blunt, very obtusely triangular at most, whereas in *belgaense* they are narrowly and acutely elongate–triangular.

In one respect it is difficult to fit *belgaense* into the key as its SI falls between the two limits given in couplet 8, where the first half has SI 75–86, and the second half 90–105. However, as the range of *belgaense* is 88–92 it was decided to run it through the second half of couplet 8 as its measured SI is above the upper level of the range given in the first half whilst its upper level is within the range given in the second half of the couplet.

Material examined

India: Mysore, 10 miles [23 km] S. Haliyal, 500 m, 16.ii.1962 (*E. S. Ross & D. Cavagnaro*).

Tetramorium palaense n. sp.

(Fig. 56)

HOLOTYPE WORKER. TL 3·9, HL 0·92, HW 0·84, CI 91, SL 0·78, SI 93, PW 0·67, AL 1·14.

Antennae with 11 segments. Mandibles finely longitudinally striate. Clypeus without a median notch but the anterior apron with a feeble impression. Frontal carinae long and strong, sinuate, almost reaching occiput before becoming indistinguishable from remaining rugose sculpture. Propodeal spines long and narrow, slightly upcurved apically in profile. Metapleural lobes elongate-triangular. Node of petiole in profile long and low, with a short anterior face, a long, gently convex dorsum and a long posterior face, the posterodorsal angle rounded; postpetiole in profile low and evenly shallowly convex dorsally. Petiole in dorsal view longer than broad. Entire dorsum of head coarsely reticulate-rugose, the clypeus similarly sculptured and without a median longitudinal carina. Dorsal alitrunk coarsely reticulate-rugose as the head, the reticular spaces on both head and alitrunk mostly smooth, with only very feeble superficial ground-sculpture. Sides of petiole and postpetiole rugulose, the latter more feebly so than the former. Dorsum of petiole with an unsculptured shining median longitudinal strip, dorsum of postpetiole unsculptured. First gastral tergite unsculptured, smooth and shining. All dorsal surfaces of head and body with numerous elongate hairs, the largest of those on the alitrunk longer than those on the first gastral tergite. Dorsal (outer) surfaces of hind tibiae with scattered short, erect to suberect hairs, the scapes with short fine hairs. Colour blackish brown.

PARATYPE WORKERS. As holotype, the colour varying from dark brown to almost black and with a range of dimensions TL 3·7–4·0, HL 0·86–0·94, HW 0·78–0·86, CI 90–93, SL 0·72–0·80, SI 90–95, PW 0·62–0·70, AL 1·06–1·18 (34 measured).

Holotype worker, **Borneo**: Sarawak, 4th Division, Gunong Mulu Nat. Pk, R.G.S. Expd., Long Pala, 19.ix.1977, lowl. rainfor., soil pocket on rock (*B. Bolton*) (BMNH).

Paratypes. 27 workers with same data as holotype and 24 workers with same data but 20.ix.1977 (BMNH; MCZ, Cambridge; NM, Basle; USNM, Washington; MHN, Geneva).

Very closely related to *vertigum* Bolton of Sulawesi and running to that species in the key (Bolton, 1977 : 73); *palaense* is best separated as follows.

palaense	*vertigum*
Frontal carinae strong, almost reaching to occiput.	Frontal carinae weak, quickly fading out behind level of eyes.
Antennal scrobes developed.	Antennal scrobes vestigial.
Posterior face of petiole not convex in profile, not overhanging petiole–postpetiole junction.	Posterior face of petiole convex in profile, overhanging petiole–postpetiole junction.
Side of postpetiole rugulose.	Sides of postpetiole smooth.
Antennal scapes shorter, SI 90–95.	Antennal scapes longer, SI 97–105.
Anterior clypeal apron slightly indented medially.	Anterior clypeal apron evenly convex.

Tetramorium rekhefe sp. n.

(Fig. 58)

HOLOTYPE WORKER. TL 3·6, HL 0·86, HW 0·80, CI 93, SL 0·70, SI 87, PW 0·60, AL 0·96.

Antennae with 12 segments. Mandibles coarsely longitudinally striate. Anterior clypeal margin entire, the median portion flat to very slightly concave. Frontal carinae more strongly developed than rugose sculpture of head, approaching occipital margin. Sides of head behind eye in full-face view shallowly but evenly convex. Eyes moderate, maximum diameter 0·18, about 0·22 × HW. Alitrunk in profile short and deep, the metanotal groove impressed. Propodeal spines long and strong, fully three times longer than the upcurved triangular metapleural lobes. Peduncle of petiole long and downcurved along its length. Petiole node in profile relatively high and narrow, the tergal portion higher than the dorsum is long, the dorsal surface shallowly convex and both antero- and posterodorsal angles rounded. In dorsal view the petiole node considerably broader than long. Clypeus with three longitudinal carinae. Dorsum of head with seven irregular but widely spaced longitudinal rugae between frontal carinae at level of eyes, these anastomosing and forming a weak occipital reticulum. Spaces between the rugae smooth, with only the most superficial traces of ground-sculpture. Dorsal alitrunk with a loose, wide-meshed open rugoreticulum, the interspaces shining. Petiole and postpetiole everywhere with a feeble superficial punctulation, the former also with faint rugular traces laterally. First gastral tergite with feeble traces of a superficial reticulum which is not raised but rather forms a faint surface pattern. All dorsal surfaces of head and alitrunk with numerous fine hairs but the dorsal (outer) surfaces of the hind tibiae only with short pubescence which is decumbent or strongly curved. Colour dark reddish brown, the gaster and pedicel blackish brown.

PARATYPE WORKERS. As holotype but with 7–8 cephalic rugae and measuring HL 0·88–0·90, HW 0·82–0·83, CI 92–93, SL 0·70–0·72, SI 84–87, PW 0·60–0·63, AL 0·98–1·04 (2 measured).

Holotype worker, **Portuguese Timor**: Baucau, 29–31.vii.1972 (*W. L. Brown*) (MCZ, Cambridge).
Paratypes. Two workers with same data as holotype (MCZ, Cambridge; BMNH).

This species is a member of the *ornatum*-group and is closely related to *navum* Bolton, to which point it runs in the key. The two are separated by the following.

navum	*rekhefe*
Median portion of clypeus with 5 carinae.	Median portion of clypeus with 3 carinae.
Cephalic sculpture of very strong carinae.	Cephalic sculpture of feebler rugae.
Petiole node in dorsal view longer than broad.	Petiole node in dorsal view much broader than long.
Tergum of petiole node longer than high.	Tergum of petiole node higher than long.
Petiole dorsum rugulose, postpetiole dorsum unsculptured.	Dorsum of both petiole and postpetiole weakly superficially punctulate.
Scapes relatively and absolutely shorter, SL 0·56–0·64, SI 76–81.	Scapes relatively and absolutely longer, SL 0·70–0·72, SI 84–87.

Tetramorium ocothrum sp. n.

(Fig. 57)

HOLOTYPE WORKER. TL 2·9, HL 0·64, HW 0·56, CI 87, SL 0·47, SI 84, PW 0·42, AL 0·70.

Antennae with 12 segments. Mandibles delicately longitudinally striate. Anterior clypeal margin convex and entire. Frontal carinae reaching a level about halfway between posterior margins of eyes and occipital corners, weak throughout their length, no stronger than the cephalic sculpture with which they merge posteriorly. With head in full-face view the sides evenly convex, the occipital margin transverse, not concave medially. Eyes moderate, maximum diameter 0·12, about 0·21 × HW, situated in front of the midlength of the sides. Dorsal alitrunk evenly convex in profile, in dorsal view the pronotal corners rounded. Propodeal spines short, narrow and spiniform, slightly longer than the acute triangular metapleural lobes. Petiole in profile with a long, downcurved anterior peduncle and a low dome-shaped node with broadly rounded antero- and posterodorsal angles and an evenly convex dorsum. In dorsal view the petiole node subglobular, slightly broader than long. Postpetiole with an anterior peduncle which is narrower than the node itself, the whole segment longer than broad. Dorsum of head covered with a mass of fine, irregular, dense confused rugulation, the interspaces finely punctulate. Dorsal alitrunk with a fine open rugoreticulum. Petiole and postpetiole unsculptured dorsally but the former with lateral traces of faint punctulation. Gaster unsculptured. All dorsal surfaces of head and body with numerous elongate fine hairs but the dorsal (outer) surfaces of the hind tibiae only with short, appressed pubescence. Colour black.

Holotype worker, **Borneo**: Sarawak, 4th Division, Gunong Mulu Nat. Pk, RG.S.. Expd. Long Pala, lowl. rainfor., on tree trunk, 14.x.1977 (*B. Bolton*) (BMNH).

A species of the *tonganum*-group, most closely related to *tonganum* itself and running out with that species in the key (Bolton, 1977 : 77). The two are quickly separable by colour, *tonganum* being yellowish brown or mid-brown whilst *ocothrum* is black. Apart from this the eyes of *tonganum* are slightly larger (0·24–0·27 × HW) and the cephalic sculpture is more regular, not so nearly disorganized in appearance as in *ocothrum*.

The *obtusidens*-complex

In the previous part of this study (Bolton, 1977 : 101) a number of samples were treated under the name *T. obtusidens* Viehmeyer, and I said at the time that, 'I suspect that the name *obtusidens* may conceal more than one valid species'. Now I am of the opinion that three separate species exist in this complex of the *bicarinatum*-group. They are characterized within the group by their small size (HW<0·65, SL<0·55), smooth unsculptured mandibles, pale yellow colouring and vestigial or absent basigastral sculpture. All three will run out to *obtusidens* in the 1977 key but may be separated as follows.

a Alitrunk in dorsal view with a strong transverse carina at the pro-mesonotal junction. Postpetiole dorsum with strong rugulose sculpture. (Thailand, Borneo) . . . **adelphon** (p. 177)
– Alitrunk in dorsal view without a transverse carina at the pro-mesonotal junction. Postpetiole dorsum punctulate or with 1–2 very faint rugulae . . . . b
b Hairs on dorsal alitrunk abundant, fine, curved or sinuate. Smaller species, HW<0·55. (Singapore) . . . . **obtusidens** (p. 178)
– Hairs on dorsal alitrunk sparse, stout, more or less straight and blunted apically. Larger species, HW>0·55. (New Guinea) . . . . **kydelphon** (p. 177)

Tetramorium adelphon sp. n.

HOLOTYPE WORKER. TL 2·8, HL 0·68, HW 0·58, CI 85, SL 0·48, SI 83, PW 0·43, AL 0·78.

Antennae with 12 segments. Mandibles unsculptured, smooth and shining with scattered hair-pits. Anterior clypeal margin with a shallow median impression. Frontal carinae strong and running almost to occipital corners before blending into the occipital rugoreticulum, and surmounted to this point by a narrow raised rim or flange. Maximum diameter of eye 0·17, about 0·29 × HW. Propodeal spines in profile elongate and narrow. Metapleural lobes triangular, broad basally but rapidly tapering to an acute apex. Petiole node in profile shaped as in *insolens* (Fig. 45, this paper), longer than broad in dorsal view. Clypeus sculptured only with the three longitudinal carinae typical of this group. Dorsum of head in front of the level of the eyes with 5 longitudinal rugulae between the frontal carinae, occipitally with a strong rugoreticulum and between these two zones with an area in which the longitudinal rugulae continue but which also has a few cross-meshes. Dorsal alitrunk reticulate-rugose and with a strong transverse carina at the junction of pro- and mesonotum. Petiole dorsum reticulate-rugulose, postpetiole dorsum similarly but less strongly sculptured. First gastral tergite without basal costulae. All dorsal surfaces of head and body with stout, stiff erect or suberect hairs. Colour pale yellow.

Holotype worker, **Borneo**: Sarawak, 4th Division, Gunong Mulu Nat. Pk, R.G.S. Expd. Long Pala, lowl. rainfor., leaf litter, 28.ix.77 (*B. Bolton*) (BMNH).

NON-PARATYPIC MATERIAL

Also placed in this species is a single worker from Thailand: Nong Hoi, 21.vii.1975 (*D. Jackson*) which closely resembles the holotype but has the anterodorsal petiole angle rather more acutely developed. It has almost the same measurements as the holotype (TL 3·0, HL 0·70, HW 0·61, CI 87, SL 0·50, SI 82, PW 0·44, AL 0·80) and shares the diagnostic characters of the holotype.

The strong transverse carina on the dorsal alitrunk quickly separates *adelphon* from related species in the Oriental and Indo-Australian regions, but this character also occurs in the small yellow African species related to *phasias* Forel, which may turn out to be more closely related to *adelphon* than either *obtusidens* or *kydelphon*.

Tetramorium kydelphon sp. n.

HOLOTYPE WORKER. TL 3·4, HL 0·78, HW 0·64, CI 85, SL 0·52, SI 81, PW 0·48, AL 0·92.

Antennae with 12 segments. Anterior clypeal margin with a very feeble median indentation. Mandibles unsculptured except for hair-pits. Frontal carinae strong, running almost to occipital corners before becoming confused with the occipital rugoreticulum and surmounted throughout their length by a narrow raised rim or flange. Maximum diameter of eye 0·18, about 0·28 × HW. Propodeal spines elongate but broad in profile, elevated. Metapleural lobes narrowly elongate-triangular. Petiole node in profile shaped as in *insolens* (Fig. 45, this paper), in dorsal view as broad as long. Dorsum of head with irregular, spaced-out longitudinal rugulae and with a weak occipital rugoreticulum. Dorsal alitrunk reticulate-rugose but without a transverse carina at the pro- and mesonotal junction. Petiole dorsum weakly rugulose, the postpetiole dorsally with a few very faint longitudinal markings and a little very feeble punctulation. Gaster unsculptured. All dorsal surfaces of head and body with stout, stiff, erect or suberect hairs. Colour pale yellow.

Holotype worker, **New Guinea**: Papua, Karema, Brown R., no. 601, 8–11.iii.1955 lowl. rainfor. (*E. O. Wilson*) (MCZ, Cambridge).

Paratypes. A worker and a queen with same data as holotype (BMNH). Also to be included as paratypes are other members of this series and two New Guinea series from Lai and Huon Peninsula, Lower Busu River (*E. O. Wilson*) at present housed in MCZ, Cambridge and referred previously (Bolton, 1977 : 102) to *obtusidens*.

Tetramorium obtusidens Viehmeyer

Following the removal of *adelphon* and *kydelphon* from the series formerly associated with *obtusidens* it is necessary to make a few adjustments to the description of this species.

WORKER. TL 2·4–2·7, HL 0·58–0·64, HW 0·49–0·54, CI 81–85, SL 0·38–0·42, SI 77–80, PW 0·34–0·38, AL 0·68–0·74 (8 measured).

With the general characters of the complex and of the *bicarinatum*-group to which it belongs, but with additional characters as follows. Frontal carinae less strongly developed than in *adelphon* or *kydelphon*, extending back beyond level of eye but weak, scarcely stronger than other cephalic rugulae. Maximum diameter of eye 0·12–0·14, about 0·25–0·27 × HW. Petiole node in dorsal view as broad or slightly broader than long. Dorsum of head irregularly longitudinally rugulose, with a reticulum occipitally. Dorsal alitrunk reticulate-rugulose but without a raised transverse carina at the promesonotal junction. Petiole dorsum with sparse rugulae, postpetiole dorsally with fine superficial punctulation, at most with only one or two very feeble longitudinal marks. Pilosity on dorsal surfaces of head and body much denser than in *adelphon* or *kydelphon*, the individual hairs finer and more flexuous than in those species. Colour pale yellow.

With the removal of *adelphon* and *kydelphon*, *obtusidens* is known only from Singapore. To the present it is the smallest known member of the *bicarinatum*-group.

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Additions and corrections to 'A reclassification of the subfamily Agrypninae (Coleoptera : Elateridae)'

C. M. F. von Hayek

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Additions and corrections to 'A reclassification of the subfamily Agrypninae (Coleoptera: Elateridae)'

C. M. F. von Hayek

Department of Entomology, British Museum (Natural History), Cromwell Road,
London SW7 5BD

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Synopsis

This work is a continuation of Hayek (1973). With its completion all the nominal species included in the Agrypninae up to the end of 1977, with the exception of nine species which remain unrecognized, are assigned to an appropriate genus. A revised key to include the recently described genus *Stangellus* Golbach is provided. One hundred and thirteen new combinations are proposed. Eighteen specific names are newly placed in synonymy and eight specific synonymies confirmed. One species is extracted from synonymy and transferred to another subfamily. The type-material of two species previously listed as Incertae Sedis has been located and examined. The location of the type-material of two hundred species is recorded and eighty-one lectotypes newly designated. Additional type-material of fifty-two species is also recorded.

In an Appendix the subdivision of the Agrypninae into groups based on certain external characteristics and the structure of the female genitalia is proposed.

Introduction

Since the publication of the first part of this work (Hayek, 1973) I have been able to locate and examine the type-material of almost all the species which were not included in that volume and to place them in the appropriate genus. The generic attribution of the remaining species is based on the descriptions. To the best of my belief the generic status of every species included in the Agrypninae up to the end of 1977 has now been reviewed. It has proved possible to give generic attributions for all except nine species which despite all my efforts have remained unknown to me.

The key to the genera has been corrected and modified to include the recently described genus *Stangellus* Golbach. The genus is discussed on p. 191 and in the Appendix.

Attention must be drawn to the fact that there is no doubt that the subfamily Agrypninae as constituted in this work cannot be regarded as a natural assemblage of genera. It was originally adopted by the writer because it was the one used in the most recent practical key to the subfamilies of the Elateridae of the world (Fleutiaux, 1941*a* : 36). My main aim, in which I believe

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that I have succeeded, was to bring order into the chaos existing within a fairly easily recognizable group of Elateridae.

In the course of the preparatory work for this volume it became increasingly clear that the genus *Lanelater* is more closely related to *Pyrophorus* and its allies than to the remaining Agrypninae. I believe that the genera here regarded as forming the subfamily Agrypninae should be treated as part of the larger assemblage first termed the Pyrophorinae by Hyslop (1917) who based his classification on the structure of the larvae. Crowson (1961), by drawing attention to the presence of setae at the base of the claws of the adults of those species whose larvae are known to have the characteristics of Hyslop's Pyrophorinae, had some success in his attempt at restoring congruity to the adult and larval systems of the family. Unfortunately he was mistaken in his belief that in the females of these species the valves of the ovipositor always lack styli.

Gurjeva (1974), who based her classification on the structure of the thorax, and Dolin (1975), who studied the structure of the wings and took into account the anatomy of the larvae, use the name Agrypninae for the same genera, either by name or by implication, as those referred to by Hyslop and Crowson under the name Pyrophorinae. Gurjeva and Dolin credit the name to Lacordaire, 1857. I believe that they are correct in the use of the name Agrypninae but consider that Candèze, 1857 is the author as his work, with the tribe Agrypnides, appeared in May one month before that of Lacordaire.

This work follows the same arrangement as Hayek (1973) and should be used in conjunction with it. The corrigenda to Hayek (1973) will be found on p. 248.

Additions to the list of abbreviations and symbols used by Hayek (1973)

[p. 1]	page numbers within square brackets refer to Hayek (1973).
CNC, Ottawa	Canadian National Collection, Canada.
FML, Tucuman	Fundación Miguel Lillo, Argentine.
NM, Prague	Národni Muzeum v Praze, Czechoslovakia.
NSM, Tokyo	National Science Museum, Tokyo.
QM, Brisbane	Queensland Museum, Australia.
UZI, Lund	Universitetets Zoologiska Institution, Sweden.

Revised key to genera and subgenera [p. 6]

(Modified to include *Stangellus* Golbach. Page references are given to both Hayek (1973) and the present work.)

1 Propleurae with longitudinal grooves near the lateral margin for the accommodation of the antennae. Posterior portion of prosternopleural suture grooved for the reception of the anterior tarsi . . . . ***OCTOCRYPTUS*** Candèze (1973 : 266 and p. 247)

– Propleurae without longitudinal grooves near the lateral margin for the accommodation of the antennae. Prosternopleural suture never modified for the reception of the tarsi 2

2 Mesepisternum forming part of margin of middle coxal cavity (1973 : Fig. 1). Tibial spurs present (1973 : Fig. 9). Vestiture setose, scales entirely absent ***LANELATER*** Arnett (1973 : 240 and p. 246)

– Mesepisternum not forming part of margin of middle coxal cavity (1973 : Figs 2 & 3). Tibial spurs absent (1973 : Fig. 10). Vestiture generally scaly 3

3 Mesepimeron not forming part of margin of middle coxal cavity (1973 : Fig. 2) . . . 4

– Mesepimeron forming part of margin of middle coxal cavity (1973 : Fig. 3) 8

4 Tarsal segments 1–4 expanded laterally (1973 : Fig. 17) ***TRIERES*** Candèze (1973 : 239 and p. 246)

– Tarsal segments 1–4 not expanded laterally (1973 : Figs 15 & 16) 5

5 Small species, less than 5 mm long. Prothorax constricted immediately behind the anterior angles. Lateral carina not attaining anterior margin of prothorax ***RISMETHUS*** Fleutiaux (1973 : 235 and p. 244)

– Larger species or, if less than 5 mm long, the prothorax not constricted behind the anterior angles and the lateral carina attaining the anterior margin of the prothorax. 6

6 Scutellum with longitudinal carina 7

– Scutellum simple, without carina . . . . ***AGRYPNUS*** Eschscholtz (1973 : 113 and p. 205)

7 Propleurae without tarsal grooves . . ***MERISTHUS*** Candèze s. str. (1973 : 231 and p. 243)

– Propleurae with tarsal grooves ***MERISTHUS*** subgenus ***SULCIMERUS*** Fleutiaux (1973 : 231 and p. 243)

8 Claws without basal setae (1973 : Fig. 12) . . ***DANOSOMA*** Thomson (1973 : 87 and p. 202)

– Claws with basal setae (1973 : Fig. 11) 9

9 Second and third antennal segments subequal (1973 : Fig. 13). If the third is triangular and longer than the second, then propleural tarsal grooves are present and run parallel to the antennal grooves 10

– Second and third antennal segments not subequal (1973 : Fig. 14). The third segment as long as the fourth but sometimes of a different shape 12

10 Propleurae and metasternum with well-defined grooves for the reception of the tarsi. Metasternal tarsal grooves or depressions, directed laterally; the distal end of these grooves, if produced, would cut the posterior margin of the metasternum (1973 : Fig. 4) ***OPTALEUS*** Candèze (1973 : 91 and p. 202)

– Propleurae and metasternum with or without grooves for the reception of the tarsi. Metasternal tarsal grooves or depressions, if present, directed laterally; the distal end, if produced, would cut the lateral margin of the metasternum at a point at or within the anterior three-quarters of its length (1973 : Fig. 6) 11

11 Lateral margins of pronotum with a band of closely packed scales ***SCAPHODERUS*** Candèze (1973 : 51)

– Lateral margins of pronotum without a band of closely packed scales 11a

11a Antennal groove extending the whole length of the prosternopleural suture ***STANGELLUS*** Golbach (p. 191)

Antennal groove not extending beyond the anterior half of the prosternopleural suture ***ADELOCERA*** Latreille (1973 : 13 and p. 188)

12 Tarsal segments without ventral lobes (1973 : Fig. 15) 13

– One or more tarsal segments with ventral lobes (1973 : Fig. 16) 15

13 Lateral margins of prothorax not carinate . . . ***EIDOLUS*** Candèze (1973 : 90 and p. 202)

Lateral margins of prothorax carinate 14

14 Posterior prosternal process directed upwards immediately behind the anterior coxae ***CANDANIUS*** Hayek (1973 : 85)

– Posterior prosternal process not directed upwards immediately behind the anterior coxae ***LACON*** Castelnau (1973 : 52 and p. 192)

15 Abdomen with grooves for the reception of the hind tarsi ***ACROCRYPTUS*** Candèze (1973 : 92 and p. 203)

– Abdomen without grooves for the reception of the hind tarsi 16

16 African species. Antennal groove not extending beyond the anterior half of the prosternopleural suture 17

– American and Indonesian species. Antennal groove extending beyond the anterior half of the prosternopleural suture . . . . . . ***DILOBITARSUS*** Latreille (1973 : 93 and p. 203)

17 Prothorax cylindrical. Head with a pair of tubercles directed anteriorly. Frons not margined anteriorly . . . . ***ELASMOSOMUS*** Candèze (1973 : 101 and p. 204)

– Prothorax not cylindrical. Head without tubercles. Frons margined anteriorly ***HEMICLEUS*** Candèze (1973 : 108 and p. 204)

Nomina nuda

The following fail to satisfy the conditions of ICZN, Article 13a.
Sulcilacon candezei Girard, 1969 : 223 and 1971 : 564.
Sulcilacon schwarzi Girard, 1969 : 223 and 1971 : 563.
Elasmosomus lamottei Girard, 1971 : 568.
Elasmosomus vanderplaetseni Girard, 1971 : 569.

Species removed from the subfamily Agrypninae [p. 11]

Elater rufipes DeGeer

Elater rufipes DeGeer, 1774 : 150.

Syntypes examined. 6 ex. standing as *E. rufipes* DeGeer (DeGeer collection, NR, Stockholm). The specimens lack any locality or determination labels. All are *Prosternon tessellatum* (Linnaeus,

1758) and *Elater rufipes* DeGeer is therefore a synonym **(syn. n.)** of *Prosternon tessellatum* (Linnaeus, 1758).

E. rufipes was synonymized with *murinus* Linnaeus by Goeze, 1777 : 557 and this has been followed by subsequent cataloguers.

DeGeer refers to *murinus* of Linnaeus, *Faun.* Ed. 2 no. 738 [1761] and *Syst. Ent.* 12 but in his description he states that the antennae are black though in certain individuals the antennae are the same colour as the tarsi (reddish) and can be hidden in grooves in the prothorax. This suggests that he had before him specimens of *tessellatum* Linnaeus and *murinus* Linnaeus. It is my opinion that DeGeer's intention was to describe the species now known as *Prosternon tessellatum* (Linnaeus) and that he regarded the *murinus* specimens as another form of his new species.

It seems probable that at some time in the last two hundred years someone removed the *murinus* specimens from DeGeer's series of *rufipes*.

Species incertae sedis [p. 12]

Adelocera kikuchii Miwa

Adelocera kikuchii Miwa, 1929 : 226.

Holotype. TAIWAN: ♂, Horisha 1 28.iv.1927 (*K. Kikuchii*). Not examined.

Dr H. Ohira (pers. comm.) reports that he was unable to find the type in the collection of the Taiwan Agricultural Research Institute, Taipei which contains many of Miwa's types.

The structure of the antennae (second segment smaller than the rest, loc. cit. : 225) suggests that this is a *Lacon* species.

Agrypnus ornaticollis Castelnau

Agrypnus ornaticollis Castelnau, 1840 : 248.

The description is based on an unrecorded number of specimens from Brazil measuring 5 lig. (=11·3 mm if French lines are intended).

I have been unable to locate this material in the MNHN, Paris or in any other institution which contains Castelnau material (see Hayek, 1973 : 273).

Candèze (1857 : 57), who based his interpretation on the very short description, regarded *ornaticollis* as a synonym of *pennata* F. (=*Lacon discoidea* (Weber)) from the U.S.A., Brazil being an erroneous locality. Candèze may be right but as Castelnau's description also fits *Dilobitarsus vitticollis* (Fairmaire & Germain) Chile, length 12–16 mm or *Lacon pectinicornis* Champion (Nicaragua, length 12 mm), I believe *ornaticollis* is best regarded as unrecognized.

Agrypnus squalidus Fairmaire

Agrypnus squalidus Fairmaire, 1849 (January) : 35.
Adelocera squalida (Fairmaire, 1849*a* (July) : 359).

The Latin descriptions of the two species are identical with the exception of 'summo tenuiter sulcato' which replaces 'summo tenuiter impresso' used in the first description. It seems probable that at some time between preparing the first description and the second, which is augmented by a longer French description, Fairmaire decided that *squalidus* (and also *pruinosus*, see p. 199) was better accommodated in *Adelocera* than in *Agrypnus*. I believe that there can be no doubt that the descriptions of *Adelocera squalida* Fairmaire, 1849 and *Agrypnus squalidus* Fairmaire, 1849 are based on the same material.

Fairmaire does not record how many specimens he had of *Agrypnus squalidus* but he states that *Adelocera squalida* was described from a single specimen found by M. Vesco in Tahiti in the decaying fruit of *Inocarpus edulis*.

Some of the syntype material of *Agrypnus pruinosus* Fairmaire which was described at the same time is in the MNHN, Paris (see p. 198) but up till now I have been unable to locate the holotype of *squalidus* Fairmaire.

Candèze (1874 : 27) synonymized *squalidus* with *modestus* Boisduval. *Lacon modestus* (Boisduval) is a very variable and widespread species and the synonomy may well be justified, but in the absence of the type to confirm the synonomy I believe the species is best regarded as unrecognized.

Elater cruentus Olivier

Elater cruentus Olivier, 1790 : 45, pl. 4, fig. 42*a*, *b*.

The description is based on an unrecorded number of specimens from 'la Côte de Barbarie' [probably N. Morocco, Algeria or Tunisia but possibly Somali Republic] in Marsham's collection.

Marsham's collection was broken up, the greater part being acquired by the BMNH via J. C. Stephens (Horn & Kahle, 1936 : 166; Hammond, 1972). As there is no record of this species in any of the BMNH lists or catalogues and as no specimens which could be from Marsham's collection can be found it must be assumed that the specimen or specimens are lost. The fate of the remainder of the Marsham collection is unknown.

Despite the difference in the localities Schoenherr (1817 : 302) listed *cruentus* Olivier as a possible synonym of *pennatus* Fabricius (together with *Lacon discoideus* (Weber)) from Carolina, U.S.A. and this synonymy is recorded in the Schenkling catalogue (1925 : 14).

Olivier's figure agrees well with *discoideus* (Weber), far better than any North or East African species known to me, but as there is no type-material extant I consider it best to regard it as a taxon of uncertain taxonomic position.

The name *cruentus* Olivier, 1870 has never, to the best of my belief, been used as a senior synonym of *discoideus* Weber, 1801 or *pennatus* Fabricius, 1801.

Elater taeniata Panzer

Elater taeniata Panzer, 1795 : 263.

The description is based on an unrecorded number of damaged (Panzer, 1801, heft 76, No. 5) specimens. The fate of Panzer's collection is unknown (Eisinger, 1919).

E. taeniata Panzer was synonymized with *E. fasciatus* Fabricius (=*Danosoma*) by Schoenherr (1817 : 282) and this synonymy has been generally accepted by cataloguers.

Panzer's (1801, loc. cit,) redescription is accompanied by a figure. Illiger (presumably in litt., see Panzer, 1805, Vorbericht) believed it to be a variety of *fasciatus* Fabricius but Panzer (1805 : 108) does not agree with this and again treats it as a good species.

Panzer's figure is difficult to identify. I do not think it is a small *fasciatus* (Linnaeus). It could be *Agrypnus murinus* (Linnaeus) or *Prosternon tesselatum* (Linnaeus). In the circumstances I believe the best course is to regard it as unrecognized.

Elater thoracicus Scopoli

Elater thoracicus Scopoli, 1763 : 92.

As Scopoli's collection seems to have been destroyed (Horn & Kahle, 1936 : 252; Higgins, 1963 : 167) there is no means of telling whether Fabricius' (1775 : 211) synonymy with *tessellatus* Fabricius (=*Actenicerus sjaelandicus* Müller) or Schrank's (1872 : 164) synonymy with *murinus* Linnaeus (*Agrypnus*), which is given in the Junk Catalogue, is correct. The description could apply to either species. In my opinion the species is best regarded as unrecognized.

Lacon adanensis Jagemann [p. 12]

See *Adelocera pygmaeus* (Baudi) p. 190.

Lacon anathesinus Candèze [p. 12]

See *Agrypnus anathesinus* (Candèze) p. 207.

Lacon senilis Peringuey

Lacon senilis Peringuey, 1892 : 44.
Adelocera senilis (Peringuey) Fleutiaux, 1926 : 99.

The description is based on an unrecorded number of specimens presumably (Peringuey, loc. cit. : 1) collected by Mr A. W. Eriksson in Northern Ovampoland [or Ovamboland, South West Africa, probably the area between 15°15′ S to 20°45′ S and 15° E to 21°20′ E, see Trimen, 1890 : 59]. On two occasions Eriksson presented his collection to the South African Museum, Cape Town (Peringuey, loc. cit. : 1) and according to Horn & Kahle (1936 : 205) part of the Peringuey collection is also there. Dr A. J. Hesse has searched the SAM, Cape Town collections on my behalf but has been unable to find *senilis*. The remainder of the Peringuey collection is in the Transvaal University collection, but up till now Dr S. Endrody-Younga has not been able to find *senilis*.

The species was omitted from the Junk catalogue. There have been no subsequent records of this species.

Lacon tristis Blanchard

Lacon triste [sic] Blanchard, 1853 : 86, pl. 6, fig. 8.
Adelocera tristis (Blanchard) Fleutiaux, 1926 : 96.

The description is based on an unrecorded number of specimens collected at 'Triton Bay [West Irian] sur la côte sud de la Nouvelle Guinée' in the course of the voyage of the *Astrolabe* and *Zelée* (J. Dumont D'Urville and Jacquinot) between 1837 and 1840. Although the type-material of *Agrypnus nigroplagiatus* Blanchard (=*Lacon modestus* (Boisduval) (see Hayek, 1973 : 71)), which was described at the same time, was found in the MNHN, Paris, I have been unable to find any *tristis* syntype-material.

Blanchard comments that the species resembles *Lacon humilis* Erichson (=*Agrypnus*, see Hayek, 1973 : 165) and the figure suggests a species similar to *Agrypnus gracilis* (Candèze) but, in the absence of the type-material I consider it unwise to make a generic attribution.

Lacon variegatus Motschulsky

Lacon variegatus Motschulsky, 1854 : 45.
Brachylacon variegatus (Motschulsky) Yakobsen, 1913 : 736.
Adelocera variegatus (Motschulsky) Fleutiaux, 1926 : 96.

The description is based on an unrecorded number of specimens measuring 6 l. (=13·5 mm if French lines used) collected by Tatarinoff and Gaschkéwitsch near Pekin. What became of this collection is not recorded. If the specimens were acquired by Motschulsky they should be in ZM, Moscow.

As Motschulsky's interpretation of *Lacon* appears to have been that of other workers at that time (see *Agrypnus binodulus* (Motschulsky), Hayek, 1973 : 131) this is probably an *Agrypnus* species, but without examination of authentic material it is impossible to confirm this.

Continuation of and additions to the annotated catalogue of all species of Agrypninae [p. 12]

ADELOCERA Latreille [p. 13]

The relationships of the genus are discussed in the Appendix, p. 252.

DISTRIBUTION [p. 22]. With the transference of *minutus* (Candèze) to *Stangellus* (see p. 192) the distribution of *Adelocera* becomes limited to the Ethiopian and Oriental regions.

SPECIES INCLUDED IN THE GENUS [p. 22]. With the transference of *A. minutus* (Candèze) to *Stangellus* and the assignment of 6 species to *Adelocera* the genus now includes 80 species.

Adelocera acerbus (Candèze) **comb. rev.**

Lacon acerbus Candèze, 1888 : 670.
Adelocera acerbus (Candèze); Fleutiaux, 1926 : 96.
Agrypnus acerbus (Candèze); Hayek, 1973 : 120.

Holotype. BURMA: ♂ Bhamo, Birmania, Fea, viii.1885; Typus; acerbus Cand. [unknown handwriting replacing Candèze's determination label which is stuck on an index card] (MCSN, Genoa).

The determination label is probably a replacement for Candèze's label which is almost certainly stuck on an index card. See also Van Zwaluwenburg (1959 : 352), *Adelocera* (*Compsolacon*) *beccari* [sic] (Candèze).

Adelocera aethiopicus (Candèze) [p. 23]

Brachylacon aethiopicus (Candèze) Cobos, 1964 : 586. Omitted from Hayek (1973).

Adelocera borneoensis (Ohira) **comb. n.**

Brachylacon (*Brachylacon*) *borneoensis* Ohira, 1973*a* : 106, fig. 41.

Holotype. BORNEO (Sabah): ♀, Forest Camp, 19 km N. of Kalabakan (BPBM, Honolulu, Type No. 9852). Not examined.

Paratype. BORNEO (Sarawak): ♀, Sarika Dist., Rejang Delta, 15–26.vii.1958; T. C. Maa (Ohira collection). Examined.

Adelocera difficilis (Lewis) [p. 28]

Additional paralectotypes examined: JAPAN: 4 ♂, 2 ♀, Japan, G. Lewis, 1910 : 320 (BMNH). The specimens lack any indication of the locality but I believe I am justified in regarding them as part of the syntype series (see Hayek, 1973 : 277).

Adelocera exiguus (Candèze) [p. 30]

Lacon exiguus Candèze, 1897 : 10.
Brachylacon (*Brachylacon*) *tawauensis* Ohira, 1973*a* : 107, fig. 1B, 4M. **Syn. n.**

Brachylacon (*Brachylacon*) *tawauensis* Ohira. Holotype. BORNEO (Sabah): ♀, Tawau Residency Kalabakan R. (BPBM, Honolulu, Type No. 8958). Not examined.

Paratype. BORNEO (Sabah): ♀, British N. Borneo, Tawau Residency, Kalabakan R., Tawau 48 km W, 9–18 xi '58; Prunay Forest; T. C. Maa Collector (Ohira collection). Examined.

Adelocera gressitti (Ohira) **comb. n.**

Brachylacon (*Aganlacon*) *gressitti* Ohira, 1972*b* : 3.

Holotype. TAIWAN. ♀, Hassenzan, 24.vi.1934 (J. L. Gressitt) (BPBM, Honolulu. Type No. 9485).

The generic attribution is based on the following specimen kindly lent to me by Dr Ohira: ♂, Liukuei, Formosa, 13 viii 1972 Y. Maeda.

Adelocera hilaris (Candèze) [p. 34]

Holotype. BURMA: sex unknown, Carin Cheba, 900–1100 m, L. Fea, V.xii.88; Typus; hilaris Cand. [unknown handwriting replacement label, see *Adelocera acerbus* (Candèze) above] (MCSN, Genoa).

The inclusion of *hilaris* Candèze in *Adelocera* is fully justified.

Adelocera microcephalus (Motschulsky) [p. 38]

I have examined the following specimens from published localities. They are not *microcephalus* (Motschulsky) and belong to a species unknown to me.

1 ♂, Palon (Pegu) L. Fea VIII–IX 87 (Candèze, 1891*a* : 777). 2 ♀, Sumatra Si Rambe XII 90–III 91 E. Modigliani (Candèze 1894 : 486) (MCSN, Genoa).

Adelocera minicephalus (Ohira) **comb. n.**

Brachylacon (*Brachylacon*) *minicephalus* Ohira, 1970*b* : 236, pl. 8, fig. E.

Holotype. SINGAPORE: ♂, Singapore, 1897 (TM, Budapest).

The generic attribution is based on the description.

Adelocera minusculus (Candèze) [p. 39]

Additional paralectotype examined. INDIA: 1 ex., Bombay; minusculus Cdz. Bombay Murr. [Cand., yellow border]; Collection E. Candèze; Lacon minusculus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Adelocera minutus (Candèze) [p. 39]

See *Stangellus minutus* (Candèze) **p. 192.**

Adelocera nebulosus (Candèze) [p. 40]

Additional paralectotype examined. 1 ex., Indes Orientales; nebulosus Cdz. Ind. Or. [Cand., yellow border]; Collection E. Candèze; Lacon nebulosus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Adelocera palawanensis (Ohira) **comb. n.**

Brachylacon (*Brachylacon*) *palawanensis* Ohira, 1974 : 165.

Holotype. PHILIPPINES: ♂, Palawan, Uring Uring, 14.viii.1961. Collected by the Noona Dan Expedition 1961–62 (UZM, Copenhagen).

The generic attribution is based on the description.

Adelocera pygmaeus (Baudi) [p. 45]

Lacon pygmaeus Baudi, 1871 : 49.
Lacon adanensis Jagemann, 1944 : 333. **Syn. n.**

Lacon adanensis Jagemann. LECTOTYPE (present designation). TURKEY: ♂, Asia min. Adana, 06.; Lacon adanensis Jg. Type. Det. Jagemann [Jagemann] (NM, Prague).

Adelocera quadriguttatus (Candèze) [p. 45]

Holotype. SUMATRA: probably ♂, Pangherang. Pisano x.90 e iii.91 E. Modigliani Type; quadriguttatus Cand.; Lacon quadriguttatus Cand., n. sp. [Cand.] (MCSN, Genoa).

Adelocera sarawakensis (Ohira) **comb. n.**

Brachylacon (*Brachylacon*) *sarawakensis* Ohira, 1973*a* : 107, fig. 4K.

Holotype. BORNEO (Sarawak): ♀, Nanga Pelagus nr. Kapit. (BPBM, Honolulu). Not examined.

Material examined. BORNEO (Sabah): 1 ♀, North Borneo (SE), Forest Camp, 19 km N of Kalabakan 27.x.1962 Y. Hirashima. Malaise Trap (Ohira collection).

Adelocera subcostatus (Candèze) [p. 48]

Holotype. BURMA: ♀, Carin Ghecu [sic], 1300–1400 m, L. Fea, 11–iii.88; Type; subcostatus Cand. [unknown handwriting replacement label, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Adelocera tumidipennis (Candèze) [p. 50]

Lectotype, TANZANIA: sex undetermined; Viag. Raffray, Acq. Deyrolle; Type; tumidipennis Cand. [unknown handwriting replacement label, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Additional paralectotypes examined. TANZANIA: 1 ex., n. sp. tumidipennis Cdz. Zanzibar [Cand., blue border]; Collection E. Candèze; Lacon tumidipennis Cd. det. E. Candèze [IRSNB curatorial label]; Type 1 ex., Zanzibar, Raffray; Lacon tumidipennis Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

STANGELLUS Golbach

Stangellus Golbach, 1976 : 256. Type-species: *Stangellus bucheri* Golbach, by monotypy.

GENERIC DIAGNOSIS. Each claw with a group of setae at the base (1973 : Fig. 11). Tibial spurs absent (1973 : Fig. 10). Mesepisternum does not form part of margin of mesocoxal cavity; mesepimeron forms part of margin of mesocoxal cavity (1973 : Fig. 3). Second and third antennal segments subequal, each smaller than the fourth and following segments (1973 : Fig. 13). Antennal groove attaining the anterior coxae. Vestiture scale-like. Propleurae and metasternum without well defined tarsal grooves. Scutellum not carinate. Tarsi with or without ventral lobes.

The antennal structure of *Stangellus* and *Adelocera* is similar but the two genera differ in the length of the prosternal antennal groove. *Stangellus* differs from *Lacon* in the structure of the antennae but the long antennal groove which attains the anterior coxae resembles the condition found in many *Lacon* species. The male of *S. massula* is unknown, but the aedeagi of *bucheri* and *minutus* have the long lateral lobe and shorter median lobe characteristic of many species of *Lacon*. To the best of my belief this condition does not occur in *Adelocera*.

Two species are here transferred to *Stangellus*. In *S. minutus* (Candèze) the third tarsal segment is strongly oblique and the fourth distinctly lobed, a condition strongly reminiscent of that found in *Dilobitarsus*.

The characteristics by which *Adelocera*, *Dilobitarsus*, *Lacon* and *Stangellus* are separated (the size of the second and third antennal segment, length and depth of the antennal grooves and the presence or absence of tarsal lobes) are known to show considerable inter-specific variation within the Elateridae. At present it is possible to assign all known Agrypnine species to a genus but I suspect that as more material becomes available more 'borderline' species will occur. Before yet more genera are erected to accommodate them I believe a reappraisal of the value of the characters used and a search for new characters should be made. A study of the female genitalia may help to clarify the situation.

The relationships of the genus are discussed in the Appendix, p. 151.

DISTRIBUTION. Species belonging to this genus occur in Mexico, Brazil and the Argentine.

BIOLOGY AND HABITS. Nothing is known of the biology or habits of *Stangellus* species.

SPECIES INCLUDED IN THE GENUS. Three species are included in the genus. The MNHN, Paris possesses a single ♀ specimen of a new species from Argentina (Jatahay, Goyaz).

Stangellus bucheri Golbach

Stangellus bucheri Golbach, 1976 : 257.

Holotype. ARGENTINA: ♂, La Soladad, 11 km west of La Cejas Dep. Cruz Alta. Tucuman 14.x.1965. E. Bucher (FML, Tucuman).

Allotype ♀, paratypes, 2 ♂, same locality and collector (FML, Tucuman). 1 ♂, same locality and collector, kindly presented by Dr Golbach (BMNH).

Stangellus massulus (Candèze) **comb. n.**

Adelocera massula Candèze, 1882 : 2.
Lacon massulus (Candèze) Fleutiaux, 1926 : 93.

LECTOTYPE (present designation). MEXICO: ♀, n. sp. massula Cdz. Mex. [Cand., green border]; Adelocera massula Cand. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

Stangellus minutus (Candèze) **comb. n.**

Dilobitarsus minutus Candèze 1878*b* : 11 (6)
Adelocera minutus (Candèze) Hayek, 1973 : 39.

Up till now I regarded this as the only known Neotropical *Adelocera* species.

In general appearance, and especially in the form of the posterior half of the prosternum the sides of which fall almost vertically to the antennal grooves, this species bears a strong resemblance to certain *Adelocera* species (e.g. *microcephalus* (Motschulsky)) in which the posterior portion of the prosternum bears two lateral longitudinal carinae from which the sides fall fairly steeply to the sternopleural suture. A re-examination of the lectotype of *minutus* has shown that the antennal grooves attain the anterior coxae. The aedeagus has the short median and long lateral lobes which are characteristic of many *Lacon* species. To the best of my belief this condition does not occur in *Adelocera* species.

S. minutus differs from the other *Stangellus* species in that the third tarsal segment is obliquely truncate and the fourth distinctly lobed.

LACON Castelnau [p. 52]

The relationships of the genus are discussed in the Appendix, p. 151.

SPECIES INCLUDED IN THE GENUS [p. 56]. The generic attribution of 11 species has been confirmed, 9 species are transferred to the genus, 1 species is restored to the genus and 2 species placed in synonymy. The genus now includes 125 species.

Lacon altaicus (Candèze) [p. 56]

Syntype examined. MONGOLIA: 1 ex., n. sp. altaicus Cdz. Altai [Cand., yellow border]; Type; Collection E. Candèze; Adelocera altaicus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Lacon anthracinus (Candèze)

Adelocera anthracina Candèze, 1900 : 77 (1).
Lacon anthracinus (Candèze) Fleutiaux, 1926 : 93.

LECTOTYPE (present designation). MADAGASCAR: ♀, n. sp. 1897 anthracina Cand. Madag. St. [Candèze, blue border]; Collection E. Candèze; Adelocera anthracina Cd. det. E. Candèze [IRSNB curatorial label]; vid Fleutiaux 1942 Adelocera anthracina (IRSNB, Brussels).

Lacon atterimus (Candèze) [p. 57]

The lectotype designation is erroneous. The specimen is 24 mm long compared with the published length of 18 mm. Since Candèze was generally fairly accurate in his measurements I suspect that he did not have the Paris specimen before him at the time of the description. The specimens are conspecific.

LECTOTYPE (present designation). MADAGASCAR: ♂, Madag; C.M.; n. sp. atterima Cdz. Mad. Mn. [Candèze, blue border]; Collection Candèze; Adelocera atterima Cd. det. E. Candèze [IRSNB curatorial label]; Type (IRSNB, Brussels). Length 19 mm.

Lacon aurosquamosus (Jagemann) **comb. n.**

Adelocera aurosquamosa Jagemann, 1944 : 332.

LECTOTYPE (present designation). TURKEY: ♂, Asia Minor Amasia; Adelocera aurosquamosa Jg. Typus. Det. Jagemann [Jagemann] (NM, Prague).

This species bears a very close resemblance to *L. lepidopterus* (Panzer). It seems probable that, when more material of both sexes becomes available, the two species will be found to be conspecific.

Lacon balachowskyi Girard

Lacon balachowskyi Girard, 1971 : 561, figs 9, 10.

Holotype. ♂ (MNHN, Paris). Allotype ♀, paratypes 1 ♂, 1 ♀ (location unknown). IVORY COAST: Lamto, 8–4 et 10.4.1964 (*Y. Gillon*), 9–3 et 24.3.1968, 8.4.1969 (*C. Girard et R. Vauttaux*), à la lumière. Not examined. The generic attribution is accepted on the basis of the figures.

Lacon boninensis (Ohira) **comb. n.**

Alaotypus boninensis Ohira, 1970*a* : 11, figs 1, 2.

Type. JAPAN: Ogasawara Gunto [Bonin Island] ♂, Chechi-jima (NSM, Tokyo). Not examined. Paratype ♀, Hakajima 4-iv.1970, K. Kojima (Ohira collection). Examined.

Lacon braziliensis (Castelnau) **sp. rev., comb. n.**

Adelocera braziliensis Castelnau, 1836 : 14.
Adelocera rubra (Perty); Candèze, 1857 : 67, pars.
[*Adelocera rubra* (Perty); Candèze, 1889 : 71. Misidentification].

The description is based on an unrecorded number of large specimens (18 (? French) lig. =40–45 mm) from Brazil in which the posterior two-thirds of the elytral suture is black. I have been unable to locate these specimens in the IRSNB, Brussels and Dr Neboiss informs me that they are not in the NMV, Melbourne.

Apart from the size Castelnau's description fits a female specimen (length 28 mm) in the BMNH bearing Candèze's determination label 'rubra Perty'. This specimen is not conspecific with the lectotype of *Lacon ruber* Perty which does not have distinct black markings on the thorax or elytra. Selection of a neotype of *braziliensis* is postponed until more material in better condition becomes available.

Germar (1840 : 253, pl. 1, figs 2, 2a) synonymized *braziliensis* with *Agrypnus ruber* Perty. A female specimen on which Germar may have based his interpretation of *ruber* is in the BMNH. The specimen, which is from the Schaum collection, bears Germar's determination label: validus m. ruber Perty. The name *validus* was never published. It is not *ruber* Perty but conspecific with the specimen believed to be *braziliensis* Castelnau recorded above.

Candèze (1857) states that *rubra* varies in size and is brown-red in colour but that some specimens are more reddish with the margins of the elytra brown. In 1889 Candèze described *castelnaui* and his comments show that at that time he regarded *rubra* as having the suture and margins of the elytra black.

Lacon cantaloubei (Girard) **comb. n.**

Sulcilacon cantaloubei Girard, 1969 : 222, figs 1, 3.

Holotype. Cameroun: ♂ Douala, bois de Singes, X–1958 (*J. Cantaloube*) (MNHN, Paris). Not examined. The generic attribution is based on the figures.

Lacon carinensis (Candèze) [p. 59]

Holotype. Burma: ♂, Carin Ghecu 1300–1400 m. L. Fea 11–iii.88 Type; 26 [refers to aedeagus which is mounted between two cover strips and stands next to the holotype with the collection]; carinensis Cand. [unknown handwriting replacement label, see *Adelocera acerbus* (Candèze) p. 189]; Redescritto in Boll. Soc. Ent. 11 G. Binaghi det. 1941 (MCSN, Genoa).

Lacon castelnaui (Candèze) [p. 59]

A synonym of *Lacon ruber* (Perty), see p. 200.

Lacon churakagi (Ohira) **comb. n.**

Alaotypus churakagi Ohira, 1971*a* : 39.

Holotype. Japan (Ryukyu Is.): ♂, Iriomote Is., 5.viii.1968, H. Ohira (Ohira coll).

Lacon cinctus (Candèze) [p. 60]

LECTOTYPE (present designation). Sumatra: sex undetermined, cincta Cdz. Sumatra [Candèze, yellow border]; Type; Collection E. Candèze; Adelocera cincta Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Lacon cognatus (Candèze) [p. 61]

Holotype. Enggano: ♂, Engano, Bua Bua v–vi Modigliani 1891; 20 [refers to aedeagus which is mounted between two cover strips and is pinned in the collection beside the holotype]; Type; cognatus Cand. [unknown handwriting replacement label, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Lacon collisus (Candèze)

Adelocera collisa Candèze, 1889 : 70.
Lacon collisus (Candèze); Fleutiaux, 1926 : 93.

LECTOTYPE (present designation). Sikkim: sex not determined, n. sp. collisa. Cdz. Ind. [Cand., yellow border]; Type; Collection E. Candèze; Adelocera collisus Cd. det. E. Candèze [IRSNB curatorial label]; Revision Ed. Fleutiaux (IRSNB, Brussels).

The published locality is Sikkim, Himalaya.

Lacon cribratus (Candèze) [p. 61]

The specimen from the Guérin-Méneville collection on which Candèze based his description has not been located. The IRSNB, Brussels possesses two specimens from Malacca from the Candèze collection one of which bears Candèze's yellow-bordered determination label. These are presumably the specimens to which Candèze (1874 : 25) refers.

Lacon dorsalis (Candèze) [p. 62]

Adelocera dorsalis var. *obscuripennis* Fleutiaux, 1903*b* : 263.
Adelocera auricollis Schwarz, 1905*b* : 273. [Synonymized with *dorsalis* var. *obscuripennis* Fleutiaux, 1903 by Fleutiaux, 1907*a* : 162.] [Synonymy confirmed.]

Adelocera dorsalis Candèze. Additional syntype examined. MADAGASCAR: 1 ex., dorsalis Cdz. Madag. [Cand., blue border]; Type Coll. Mn,; Collection E. Candèze (IRSNB, Brussels).

Adelocera dorsalis obscuripennis Fleutiaux. LECTOTYPE (present designation). MADAGASCAR: ♀ Montagne d'Ambre; dorsalis v.obscuripennis Fleut. Type [Fleut.] (MNHN, Paris).

Paralectotype. MADAGASCAR: 1 ♀, Diego Suarez; dorsalis Cand. obscuripennis Fleut. ♀ [Fleut.] (MNHN, Paris).

Adelocera auricollis Schwarz. LECTOTYPE (present designation). MADAGASCAR: ♂, Cap d'Ambre Madagascar ex Coll. F. Schneider, Coll Schwarz; Typus; auricollis Schw. [Schwarz]; auricollis Schw. obscuripennis Fleut. [Fleut.] (DEI, Eberswalde). Length 26 mm.

Paralectotype. MADAGASCAR: 1 ♂, Diego Suarez; Typus, coll Schwarz (DEI, Eberswalde). Length 20 mm.

Schwarz was mistaken in his belief that the larger specimen was a female.

Lacon dorsalis obscuripennis appears to be restricted to the northern part of Madagascar. In addition to the type-material I have examined the following specimens: 2 ♂, 1 ♀, 1 ex., Diego Suarez; 4 ♀, 4 ex., Montagne d'Ambre; 1 ex., Region de Sakarami [12°26′ S, 49°24′ E] (MNHN, Paris).

Lacon dorsalis dorsalis has been taken at various places throughout the length of eastern Madagascar, e.g. Bai d'Antongil, Fénérive, Lac Alaotra, Tananarive, Fianarantsoa and Fort Dauphin. Material from these localities is preserved in the MNHN, Paris.

The 1973 amendment to the ICZN Article 45(e)(i) requires that the term variety used before 1961 be interpreted as denoting subspecific rank. It would appear that in this case subspecific rank is justified.

Lacon duchoni (Schwarz)

Alaotypus duchoni Schwarz, 1905*a* : 257.
Adelocera duchoni (Schwarz); Schenkling, 1925 : 12.
Lacon duchoni (Schwarz); Fleutiaux, 1926 : 93.

The description is based on 3 specimens from INDIA: Assam, Koshima received from Dohrn.

Syntype-material. DEI, Eberswalde.

The generic attribution is based on the description.

Lacon fairmairei (Candèze)

Anacantha fairmairei Candèze, 1882 : 3.
Adelocera fairmairei (Candèze) Fleutiaux, 1907 : 166.
Lacon (*Cornilacon*) *fairmairei* (Candèze) Golbach, 1970*b* : 327.

Lectotype (Fleutiaux, 1907 : 166). CHILE. ♀, Chile [bottom left hand corner of Candèze green bordered label]; Type; Acacantha fairmairei Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

Candèze based his description on an unrecorded number of specimens. Fleutiaux's (1907 : 166) statement that he saw 'le type unique' from the Brussels Museum is here accepted as the lectotype designation. It must be assumed that Candèze's determination label has been lost.

Lacon foveatus (Candèze) [p. 64]

Adelocera foveata Candèze, 1895*b* : 52.
Lacon olsoufieffi Fleutiaux, 1932*f* : 450. **Syn. n.**
Lacon olsoufieffi Fleutiaux; Hayek, 1973 : 73.

Adelocera foveata Candèze. Holotype. MADAGASCAR: ♀, n. sp. foveata Cand. Mad. du Buyss [Cand., blue border], Tamatave Pre [? illegible] Samuel; Collection E. Candèze; Adelocera foveata Cd. det. E. Candèze [IRSNB curatorial label]; vid E. Fleutiaux 1942, Adelocera foveata Cand. (IRSNB, Brussels).

Although the title of Candèze's paper suggests that the species listed and described therein were all collected by Alluaud in Diego Suarez, it is quite clear (e.g. p. 54, *Lacon procellosus* is described from specimens collected at Imerina by Sikora) that Candèze included material from other sources. Although Alluaud did pass through Tamatave (Jeannel, 1952 : 7) it seems probable that the type of *foveata* was acquired from du Buysson and had been collected by one of the many missionaries active at that time.

Lacon griseus (Schwarz)

Adelocera grisea Schwarz, 1900 : 98.
Lacon griseus (Schwarz); Fleutiaux, 1926 : 93.

The description is based on a single specimen from Buchara [Uzbekistan, U.S.S.R.] submitted by Prof. Dr O. Schneider.

Holotype. ? DEI, Eberswalde.

The generic attribution is based on the description and Schwarz's comment that the species resembles *funebris* Solsky (=*Lacon*, see Hayek, 1973 : 64).

Lacon inaequalis (Candèze) [p. 66]

Paralectotype. COLOMBIA: ♀, inaequalis; Cand. type; inaequalis Cdz. N. Gran. [? Cand.]; Collection E. Candèze; Adelocera inaequalis Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Lacon insularis (Candèze)

Adelocera insularis Candèze, 1889 : 70.
Lacon insularis (Candèze) Fleutiaux, 1926 : 93.

LECTOTYPE (present designation). ANDAMAN ISLANDS: ♀, And. Is.; n. sp. insularis Cd. And. [Cand., yellow border]; Collection E. Candèze; Adelocera insularis Cd. det. E. Candèze [IRSNB curatorial label]; Type (IRSNB, Brussels).

Lacon javanus (Candèze)

Adelocera javana Candèze, 1893*b* : 6.
Lacon javanus (Candèze) Fleutiaux, 1926 : 93.

Syntypes examined. JAVA: 1 ex., Mt. Tsikorai [sic] 4000 pds. Préangers; javanus Cand. Java Pre. [Cand.]; Collection E. Candèze; Adelocera javana Cd. det. E. Candèze [IRSNB curatorial label]; 2. 1 ex., Collection E. Candèze; Adelocera javana Cd. det. E. Candèze [IRSNB curatorial label]; 1 (IRSNB, Brussels).

The description is based on an unrecorded number of specimens from Java; Monts Tjikorai [Chicorai 7°20′ S, 107°58′ E] Préangers measuring between 15 and 17 mm in length and 4–5 mm in width. The two specimens examined measure 18 mm and 15 mm respectively. The numbers were probably attached by Van Zwaluwenburg. He did not publish a lectotype designation.

Lacon lepidopterus (Panzer) [p. 68]

Elater lepidopterus Panzer, 1801 : part 76, no. 4.
Elater chrysoprasus Herbst, 1806 : 18, pl. 159, fig. 12. [Synonymized by Gyllenhal, 1808 : 379.] [Synonymy confirmed.]
Elater grafii Schmidt, 1832 : 83. [Synonymized by Kiesenwetter, 1863 : 232.] [Synonymy confirmed.]

Elater lepidopterus Panzer. Eisinger (1919 : 91) states that the fate of Panzer's library and collection is unknown. Dr Hieke (pers. comm.) has told me that the NMHU, Berlin collection may contain some of Panzer's specimens but as all the old collections were amalgamated many years ago (see Hayek, 1973 : 275, Gerstaecker) it is impossible to identify them. The MNHU, Berlin contains 4 ♂ and 1 ♀ specimens standing beside the following manuscript label in an unknown hand: El. lepidoptera Gyll. Panz. Mik. Bohem.. One of the males bears the number 16064 and the female the number 85 in manuscript. One or more of these specimens may come from the Panzer collection and some may be *chrysoprasa* Herbst (see below). As the provenance of all the specimens is uncertain I consider it best not to select a lectotype. Fortunately there is no doubt concerning the identity of the species: all the specimens are the species generally known as *Lacon lepidopterus* (Panzer).

Elater chrysoprasus Herbst. The description is based on an unrecorded number of specimens and the figure of a specimen in the Hellwig collection. In the text Herbst refers to fig. 11 but in the caption to the plates fig. 11 is entitled *Elater pectinicornis* (which it undoubtedly is) and fig. 12 *chrysoprasus*. Gyllenhal was aware of Herbst's mistake and refers to fig. 12.

The Hellwig collection is now in the NMHU, Berlin (Horn & Kahle, 1935 : 108). Through the kindness of Dr Hieke I have been able to examine the specimens listed above under *lepidopterus* Panzer. It is believed that the series may include Herbst's material (see above).

Elater grafii Schmidt. The description is based on an unrecorded number of specimens measuring 6–7 lines (=13·1–15·3 mm if German lines are intended) collected in Krunberg in Krain [Jugoslavia] by beating a hazelnut bush in July 1832.

LECTOTYPE (present designation). ♂ in the Schmidt collection (Slovenian Natural History Museum, Ljubljana). Length: 13·2 mm.

Paralectotype. 1 ♀ with a small green label standing beside the lectotype. (Slovenian Natural History Museum, Ljubljana). Length: 13·2 mm.

The specimens stand beside an oval label with serrated edge with 'Adelocera lepidopterus Gyll.' and an illegible word in an unknown handwriting. It seems probable that this is a replacement of Schmidt's original label.

Lacon lithophilus (Candèze) [p. 69]

Syntype examined. EGYPT: 1 ex., lithophila Cdz. Aegypt [Cand.]; Collection E. Candèze; Adelocera lithophila Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels). The abdomen is missing.

Lacon luzonicus (Candèze) [p. 70]

Syntypes examined. PHILIPPINES (Luzon): 1 ♀, A luzonica Cdz. [Cand.] Marweles [?] Febr. 61 1000–4000; Luzonica Cdz. Phil. [Cand., yellow border]; Type; Collection E. Candèze; Adelocera luzonica Cd. det. E. Candèze [IRSNB curatorial label]; lectotype V. Zwal. 1957. 1 ♀, Collection E. Candèze; Adelocera luzonica Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Candèze states that he had a male and female. Van Zwaluwenburg did not designate a lectotype.

Lacon maeklinii (Candèze) [p. 70]

Alaotypus maeklinii (Candèze) Ohira, 1967*b* : 99.
Lacon maklini Candèze; Hayek, 1973 : 70. [Incorrect subsequent spelling.]

Syntype examined. JAPAN: 1 ex., mäklinii Cand. Jap. [Cand., yellow border]; Collection E. Candèze; Adelocera maklini [sic] Cd. det E. Candèze [IRSNB curatorial label]; (IRSNB, Brussels). The abdomen is missing.

Lacon maenamii (Ohira) **comb. n.**

Alaotypus maenamii Ohira, 1969*b* : 41, figs 1, 4a.

Holotype. JAPAN: ♀, Kashidate, Hachijo 1, Izu 3–4.vii.1967 T. Maenami leg. (Ohira coll.). Hachijo Island lies about 200 miles south of Tokyo.

Lacon mekrani (Candèze)

Adelocera mekrani Candèze, 1889 : 71 (5).
Adelocera makrani Schenkling, 1925 : 10. [Unjustified emendation.]
Lacon mekrani (Candèze) Fleutiaux, 1926 : 93.

LECTOTYPE (present designation). PAKISTAN: ♂, Beluchistan 7085, n. sp. mekrani Cdz. Belouchist. [Cand., yellow border]; Type; Collection E. Candèze; Adelocera mekrani Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Lacon mexicanus (Candèze) [p. 71]

Additional syntype examined. MEXICO: 1 ex., mexicana Cdz. Mex. [Cand., green border]; mexicana; Cand. type; Collection E. Candèze; Lacon mexicana Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels). This is presumably the specimen to which Van Dyke (1943 : 44) refers. It is 22 mm long.

Lacon mixtus (Candèze)

Adelocera mixta Candèze, 1878*b* : LII (5).
Lacon mixtus (Candèze) Fleutiaux, 1926 : 93.

LECTOTYPE (present designation). MEXICO: sex undetermined, n. sp. mixta Cdz. Mex. [Cand.]; Mexique; Type; Collection E. Candèze; Adelocera mixta Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Lacon modestus (Boisduval) [p. 71]

Elater castanidens Gyllenhal, 1817 : 134, no. 183.
Elater modestus Boisduval, 1835 : 108. **Syn. n.**
Agrypnus pruinosus Fairmaire, 1849 (January) : 35.
Adelocera pruinosa (Fairmaire, 1849*a* (July) : 359.) [Synonymized with *modestus* Boisduval by Candèze, 1857 : 71.] [Synonymy confirmed.]
Adelocera modesta var. *guadulpensis* Fleutiaux & Sallé, 1890 : 407(51). [Synonymized by Fleutiaux, 1926 : 94.] [Synonymy confirmed.]
Adelocera vicina Candèze, 1891*c* : 772. [Synonymized by Fleutiaux, 1926 : 94.] [Synonymy confirmed.]
Adelocera modesta var. *tessellata* Candèze. 1893*b* : 6. [Synonymized by Fleutiaux, 1926 : 94.] [Synonymy confirmed.]
Lacon vicinus (Candèze) Hayek, 1973 : 84.

Elater castanidens Gyllenhal. Syntype examined. 1 ♂, India Orientali. Kymell. (NR, Stockholm.)

The description is based on an unrecorded number of specimens from India Orientale, Dom. Kymell, Schonherr & Gyllenhal. The specimen recorded above stands in the Schonherr collection under the name *castanidens* Gyllenh. Spec Ins. 183.

The name *castanidens* does not appear in the Schenkling (1925) catalogue nor, to the best of my belief, has it been used elsewhere. *L. modestus* (Boisduval) is a very widespread species to which a number of authors have referred. In the interests of stability I have retained the name, pending an application to the I.C.Z.N. for a decision under The Plenary Powers (I.C.Z.N. Article 23 revised 1972).

Agrypnus pruinosus Fairmaire. Syntypes examined. SOCIETY ISLANDS: 1 ♂, Vesco, Taiti; Adelocera pruinosa Taiti [? Fairm.] Janson Coll. 1903: 130 (BMNH) 1 ex., Tahiti, Vesco 2·45; Adelocera Lat. Agrypnus modestus Boisduval Adelocera pruinosa Fairmaire [unknown handwriting]. 4 ex., same locality (MNHN, Paris).

Adelocera pruinosa Fairmaire. The Latin descriptions of *Agrypnus pruinosus* and *Adelocera pruinosa* Fairmaire are identical. As in the case of *Adelocera squalida* Fairmaire (see p. 186) the Latin description of *Adelocera pruinosa* is augmented by a longer French description. It seems probable that at some time between preparing the two descriptions Fairmaire decided that *pruinosus*, like *squalidus*, was better accommodated in *Adelocera* than *Agrypnus*. I believe that there can be no doubt that both descriptions are based on the same material. Fairmaire (1849 : 360) records that he examined 'une dizaine' specimens collected by Vesco. This collection, or at least part of it, appears to be in the MNHN, Paris. The specimen in the Janson collection was presumably acquired by exchange or purchase.

Adelocera modesta var. *guadulpensis* Fleutiaux & Sallé. Holotype. GUADELOUPE: ? ♀, 2 small grey labels with illegible numbers; guadulpensis Ch. Gudalp.; Collection Chevrolat; Adelocera modesta v. guadulupensis (Chv.) [Fleut.]; v. guadulpensis Cand. Mon. type [Fleut.]; Fleut. Ann. Fr. 1911 p. 265 [Fleut.]. The specimen stands over a green Chevrolat collection label: Adelocera modesta Boisd. Cand. guadulpensis Chev. olim. Mardemir Guadalpia [?, illegible]. D. Lherminier (MNHN, Paris).

Fleutiaux, (1911 : 246) credits the species to Candèze (1857 : 72) but as Candèze merely commented that he saw specimens of *modestus* Boisduval from the Antilles collected by Sallé standing under the name in the Chevrolat collection, the name *guadulpensis* cannot in my opinion be credited to Candèze.

Adelocera vicina Candèze. Examination of the available material of *modestus* Boisduval has shown that the species displays a considerable range of variation of size, colour and puncturation but that the structure of the aedeagus is remarkably constant. In my opinion there is no justification for regarding *vicina* Candèze as a separate species.

Adelocera modesta var. *tessellata* Candèze. LECTOTYPE (present designation). BORNEO: sex not determined, Suntang; n. sp. tessellata Cand. Borneo Ca. [Candèze, yellow border]; Collection E. Candèze; Adelocera tessellata Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Paralectotype. PHILIPPINES: 1 ex., Luzon, Collection E. Candèze; Adelocera tessellata Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Candèze's second specimen from Borneo has not been located. The original description is misleading. It is not until the last sentence that Candèze remarks 'c'est une varieté ou, si l'on veut, une sous-espece méritant un nom particulier'.

Lacon olivieri (Candèze) [p. 73]

The IRSNB, Brussels possesses a ♀, labelled 'Type' from Kursong, Darjeeling bearing Candèze's yellow-bordered determination label but as the specimen measures 17·8 mm compared with the published length of 15 mm and as Candèze records that there is one specimen under this name in the Janson collection I do not believe it to be part of the original type-series.

Lacon olsoufieffi Fleutiaux [p. 73]

A synonym of *Lacon foveatus* Candèze, see p. 195.

Lacon orientalis (Fleutiaux) [p. 74]

Additional paralectotypes examined: 1 ex., Tonkin, Chapa, 1 May 1915 (*R. V. de Salvaza*); Cotype; Adelocera orientalis Fleut. R. Vitalis de Salvaza det. (IRSNB, Brussels).

Lacon parallelus (Lewis) [p. 75]

Lacon (*Zalepia*) *parallelus amamiensis* Ohira, 1967*b* : 98.

HOLOTYPE. JAPAN, Ryuku Islands: ♂, Amami-Oshima (Hatsuno), 4–IV, 1966 (*T. Ito*) (Ohira collection). Not examined.

Lacon ramatasensensi (Miwa) **comb. n.**

Adelocera ramatasensensi Miwa, 1934 : 180, pl. 9, fig. 20.
Alaotypus ramatasensensi (Miwa); Ohira, 1966*b* : 215.

Holotype. TAIWAN: sex unknown, Musha 27.vii.1918 (*H. Kawamura*). Not examined.

Paratype. TAIWAN: 1 ex., Arisan vi.1914 (*M. Maki*). Not examined.

The type-material is believed to be in the Taiwan Government Research Institute, Taipei.

The generic attribution is based on the following specimen kindly presented to the BMNH by Dr H. Ohira. 1 ♀, Formosa, Tanansha, 9.vi.1972 (Y. Kiyoyama).

Lacon ruber (Perty) [p. 80]

Elater ruber Perty, 1830 : 20, pl. 5, fig. 1.
Adelocera rubra (Perty) Candèze, 1857 : 67, pars.
Adelocera castelnaui Candèze, 1889 : 71. **Syn. n.**

Elater ruber Perty. LECTOTYPE (present designation). BRAZIL: ♂, 1. Brazilia Cardiorhinus ? ruber Prty [probably Perty]; Adelocera; Type von Elater rubra Perty [curatorial label] (ZSBS, Munich).

The published locality is 'Brazilia australi, ad S. Pauli Civitatem'. The label and the handwriting agree well with that depicted in Horn & Kahle (1936 : pl. 39, fig. 37: Perty).

The genus *Cardiorhinus* was erected by Erichson in 1829. *L. ruber* Perty is superficially not unlike some of the included species (e.g. *rufilateris* Eschscholtz and *plagiatus* Eschscholtz) and it is quite possible that Perty may have believed that *ruber* should be placed in this genus. Why he decided to describe it as an *Elater* species is unknown.

Elater castelnaui Candèze. LECTOTYPE (present designation). BRAZIL: ♀, Brazil; castelnaui Cdz. Bahia, Brazil [Candèze, green border]; Collection E. Candèze; Adelocera castelnaui Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Paralectotype. 1 ♀, same labels as lectotype but without Candèze's determination label (IRSNB, Brussels).

In 1857 Candèze regarded *Adelocera rubra* Perty as a species varying in size and including specimens with unicolourous red-brown elytra and those in which the elytra were more reddish with brown-black margins.

In 1889 when he described *castelnaui* Candèze's comments show quite clearly that he misinterpreted *ruber*, believing it to have red elytra with dark marks on the suture and lateral margins. None of the specimens of *L. ruber* Perty known to me possess this colouring which is characteristic of *brasiliensis* (Castelnau) (see p. 193).

Lacon sachalinensis (Miwa) [p. 80]

A synonym of *Danosoma fasciata* (Linnaeus), see p. 202.

Lacon spurcus (Candèze) [p. 82]

Additional paralectotypes examined. LAOS: 1 ex.. Laos, Cochinch.; spurcus Cdz. Laos [Candèze, yellow border]; Collection E. Candèze; Adelocera spurcus Cd. det. E. Candèze [IRSNB curatorial label]; 2 ex., with Candèze collection and IRSNB curatorial determination label. One specimen bears the locality 'Cochinch.' (IRSNB, Brussels).

Lacon subauratus Schwarz

Adelocera subaurata Schwarz, 1904 : 46.
Lacon subauratus (Schwarz) Fleutiaux, 1926 : 93.

The description is based on an unrecorded number of specimens 17 mm long from an unknown locality in Ceylon in the Colombo Museum. Schwarz comments that this species is related to *tumulosa* Candèze (=*Lacon*, Hayek 1973 : 84). The generic attribution is based on this comment. For *Adelocera subaurata* Schwarz, 1905 see *Lacon taphrobanus* nom. n., see below.

Lacon subcostatus (Candèze) [p. 82]

Adelocera subcostata Candèze, 1857 : 69.
Lacon floridanus Knull, 1949 : 102. **Syn. n.**

Lacon floridanus Knull. Holotype. U.S.A.: ♀, Coral Gables Fla. May 1948; H. F. Strohecker colln.; Holotype Lacon floridanus Knull [Knull] (Knull collection, Ohio).

Lacon sulcifrons Candèze **comb. rev.**

Lacon sulcifrons Candèze, 1893*c* : 171.
Adelocera sulcifrons (Candèze); Fleutiaux, 1926 : 96.

Holotype. INDIA: ♀, Kanara; Mars 1893 sulcifrons Cand. Canara A [Cand., yellow border]; Collection E. Candèze; Lacon sulcifrons Cd. det. E. Candèze [IRSNB curatorial label]; Type (IRSNB, Brussels).

Lacon taphrobanus **nom. n.**

Adelocera subaurata Schwarz, 1905*a* : 257. **Sp. rev.** [Junior primary homonym of *Adelocera subaurata* Schwarz, 1904 : 46.]
Lacon subauratus (Schwarz) **comb. n.**

The description is based on an unrecorded number of specimens 18 mm long from an unknown locality in Ceylon.

Type material, ? DEI, Eberswalde.

The generic attribution is based on Schwarz's comment that the species resembles *aurulenta* Candèze (=*Lacon*, see Hayek, 1973 : 58).

Schenkling (1925 : 13) lists *subaurata* Schwarz, 1905 under *Adelocera subaurata* Schwarz, 1904 : 46. Although the names are identical and both species come from Ceylon I suspect that Schwarz is not referring to the same species. *A. subaurata* Schwarz, 1904 is 18 mm long and 3·5 mm wide and stated to be related to *tumulosa* Candèze (*Lacon*, see Hayek, 1973 : 84) while *subauratus* Schwarz, 1905 is 17 mm long, 4·5 mm wide and resembles *aurulenta* Candèze (also *Lacon*, see Hayek, 1973 : 58).

Lacon tawiensis Ohira

Lacon (*Zalepia*) *tawiensis* Ohira, 1974 : 164.

Holotype. PHILIPPINES (Sulu Archipelago): ♀, Tauri Tauri, Tarawakan, 3.x.1961 (ZMU, Copenhagen). Not examined.

Lacon tenebrionoides (Candèze) [p. 83]

Adelocera tenebrioides Candèze, 1874 : 15, 22. [Unjustified emendation.]
Lacon tenebrionoides (Candèze) Fleutiaux, 1926 : 95.

Lectotype ♂ not ♀.

Lacon vicinus Candèze [p. 84]

A synonym of *Lacon modestus* (Boisduval) see p. 198.

Lacon yayeyamana (Miwa) **comb. n.**

Adelocera yayeyamana Miwa, 1934 : 246.
Alaotypus yayeyamanus (Miwa); Ohira, 1967*b* : 98.

The description is based on an unrecorded number of specimens from JAPAN: Loo-Choo [Ryukyu Archipelago], Ishigaki Is. 27.v.1933.

Type-material. Taiwan Agricultural Research Institute, Taipei, Taiwan. Not confirmed.

Material examined. JAPAN (Ryukyu Is.); ♀, Yana, Okinawa, 10 viii 1972. Y. Araki; det. H. Ohira (BMNH).

DANOSOMA Thomson [p. 87]

The relationships of the genus are discussed in the appendix, p. 251.

Danosoma fasciata Linnaeus [p. 89]

Elater inaequalis DeGeer, 1774 : 148, No. 6, pars. [Synonymized by Gyllenhal, 1808 : 367.]
Adelocera sachalinensis Miwa, 1927 : 13, pl. 1, fig. 1. [Synonymized by Miwa, 1934 : 145.]
Lacon sachalinensis (Miwa) Hayek, 1973 : 80.
Adelocera fasciata a. *cejkai* Roubal, 1928 : 46. **Syn. n.**
Lacon fasciatus a. *ornatus* Jagemann, 1955 : 53, 288. **Syn. n.**

Elater inaequalis Degeer. LECTOTYPE (present designation); ♀, without locality or determination label standing as *inaequalis* in the DeGeer collection (NR, Stockholm).

Paralectotypes. 2 ex., without locality or determination labels standing beside the lectotype (NR, Stockholm). Both specimens are *Damosoma conspersa* (Gyllenhal).

DeGeer does not record the number of specimens he had or their locality. The description fits both *fasciata* and *conspersa* but as Gyllenhal knew both species and regarded *inaequalis* as a synonym of *fasciata* the specimen recorded above has been selected as the lectotype.

Adelocera sachalinensis Miwa. Miwa's synonymy was missed in 1973. Miwa's description and comments and the fact that *fasciata* is known to have a wide distributional range suggest that the synonymy is fully justified.

Adelocera fasciata a. *cejkai* Roubal and *Lacon fasciatus* a. *ornatus* Jagemann.

Examination of the material in the BMNH and MNHN, Paris has shown that the colour, number and distribution of the light coloured scales is very variable. In my opinion *cejkai* and *ornatus* are no more than individual variations.

Adelocera fasciata a. *cejkai* Roubal. Syntype material. CZECHOSLOVAKIA: Brezno, IV.1928 Ing. J. Čejky (probably Slovak National Museum, Bratislava). The golden scales cover the greater part of the dorsal surface leaving only isolated patches of black scales.

Lacon fasciatus a. *ornatus* Jagemann. Syntype material. CZECHOSLOVAKIA: Kelčského Javorniku (? NM, Prague). There is a transverse band of pale scales on the anterior third of the elytra.

EIDOLUS Candèze [p. 90]

I am not at all sure that the retention of this genus is justified. It differs from *Lacon* only in that the lateral margins of the prothorax are not carinate. Similar pectinate antennae and antennal grooves are found in *Lacon pectinicornis* Champion from Nicaragua and *L. subpectinatus* (Schwarz) from North Vietnam. The relationships of the genus are discussed in the Appendix p. 252.

SEXUAL DIMORPHISM. Not strongly marked. The antennae of the female appear to be less strongly pectinate than those of the male but from experience of the family this may be no more than an individual variation.

Eidolus gratiosa (Fleutiaux) [p. 90]

A synonym of *E. linearis* Candèze, see below.

Eidolus linearis Candèze [p. 90]

Eidolus linearis Candèze, 1857 : 179, pl. 3, fig. 1.
Adelocera gratiosa Fleutiaux, 1902*b* : 213. **Syn. n.**
Eidolus gratiosa (Fleutiaux) Hayek, 1973 : 90.

OPTALEUS Candèze [p. 91]

Opatelus Candèze; Hayek, 1973 : 91. [Incorrect subsequent spelling.]
Optaleus Candèze; Golbach, 1975. [Useful key to species.]

The relationships of the genus are discussed in the Appendix, p. 251.

ACROCRYPTUS Candèze [p. 92]

Apocryptus Candèze; Rye, 1876 : 290. [Incorrect subsequent spelling.]

The relationships of the genus are discussed in the Appendix, p. 251.

DILOBITARSUS Latreille [p. 93]

The relationships of the genus are discussed in the Appendix, p. 251.

SPECIES INCLUDED IN THE GENUS [p. 95]. The generic attribution of *Dilobitarsus impressicollis* Schwarz is confirmed and *Anacantha fairmairei* Candèze is transferred to *Lacon*. The genus includes 24 species.

Dilobitarsus crux (Philippi) [p. 97]

Philippi (1861 : 744) records the species from Araucania and the province of Valdivia. The province of Valdivia does not extend as far north as Araucania.

Dilobitarsus eloini Candèze [p. 97]

The type-material cannot be found in the IRSNB, Brussels and must be assumed to be lost.

Dilobitarsus impressicollis Schwarz

Dilobitarsus impressicollis Schwarz 1902*d* : 129.

LECTOTYPE (present designation). PERU: ♀, Chanchamayo; Peru D. Lange; Coll. Schwarz; Typus; impressicollis Schw. [Schwarz] (DEI, Eberswalde).

The specimen measures 14 mm compared with the published length of 15·5 mm.

Dilobitarsus quadrituburculatus Candèze [p. 99]

The type-material cannot be found in the IRSNB, Brussels and must be assumed to be lost.

Dilobitarsus sulcicollis (Solier) [p. 100]

Anacantha sulcicollis Solier, 1851 : 18.
Adelocera angustata F. A. E. Philippi, 1861 : 744. [Synonymized by Fleutiaux, 1907 : 169.]

Examination of Philippi's description has shown that there can be little doubt that Fleutiaux's synonymy is justified.

Dilobitarsus vitticollis (Fairmaire & Germain) [p. 100]

Syntype examined. 1 ♀ Adelocera vitticollis [? Fairm.]; G. Fairm.; Collection E. Candèze; Anacantha vitticollis Fairm. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels). This is probably the 'type primitif de Fairmaire' to which Fleutiaux (1907*b* : 167) refers.

ELASMOSOMUS Schwarz [p. 101]

The relationships of the genus are discussed in the Appendix, p. 252.

SPECIES INCLUDED IN THE GENUS. Two species described by Girard (1971) were omitted from the previous work and one species has been sunk in synonymy. The genus includes 30 species.

Elasmosomus christophei Girard

Elasmosomus christophei Girard, 1971 : 570, figs 17, 18.

Holotype. IVORY COAST: ♂, Lamto 16–24.4.1968, à la lumière (MNHN, Paris). Not examined.

Elasmosomus delamarei Hayek [p. 104]

See *Elasmosomus edmundi* Quelle.

Elasmosomus edmundi Quelle [p. 104]

Dilobitarsus fleutiauxi Paulian, 1947 : 87. [Synonymized by Girard, 1971 : 571.]
Elasmosomus delamarei Hayek, 1973 : 104.

Elasmosomus raffrayi (Candèze) [p. 107]

Syntype examined. TANZANIA: 1 ♂, Zanzibar Viag. Raffray. Leg. E. Deyr.; Type; raffrayi Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze), p. 189] (MCSN, Genoa).

Elasmosomus vauttouxi Girard

Elasmosomus vauttouxi Girard, 1971 : 568, figs 16, 19.

Holotype. GUINEA: ♂, Ziela, 30.3.1957 (*Lamotte, Amiet, Vanderplaetsen*) (MNHN, Paris). Not examined.

Paratypes. 4 ♂, IVORY COAST: Lamto, 25.2.1968 (*R. Vauttoux*). CENTRAL AFRICAN REPUBLIC: La Maboké, 16.9.1968, 18.2.1969 (*P. Teocchi*). Location unknown.

HEMICLEUS Candèze [p. 108]

The relationships of the genus are discussed in the Appendix, p. 252.

SPECIES INCLUDED IN THE GENUS. The generic attributions of 2 species have been confirmed. The genus includes 19 species.

Hemicleus adspersulus (Klug)

Dicrepidius adspersulus Klug, 1855 : 647.
Hemicleus adspersulus (Klug) Candèze, 1857 : 386.

LECTOTYPE (present designation). MOZAMBIQUE: ♂, 16152; adspersulus Atractodes adspersulus Klug Tette Peters [Gerstaecker] (MNHU, Berlin).

Paralectotype. 1 ♂ without any labels standing beside the above (MNHU, Berlin).

Klug did not publish any descriptions of *Atractodes* species. The specimens agree very well with the description of *Dicrepidius adspersulus* and I have no hesitation in accepting them as Klug's type-material. There can be no doubt that this is the material examined by Candèze. Why Klug changed his mind about the generic attribution remains a mystery.

Hemicleus caffer Candèze [p. 109]

The IRSNB Brussels possesses two specimens, a male from Afr. Or. Ikutha [Kenya] with Candèze's blue bordered determination label and another without a locality labelled 87.1. Both bear Fleutiaux's labels; 'Non le type, Coll. Dohrn 1930' which suggests that Fleutiaux may have examined what he believed to be the type in the Dorhn collection (IZPAN, Warsaw). The presence of this specimen in Warsaw has not been confirmed.

Hemicleus majusculus Candèze

Hemicleus majusculus Candèze, 1897 : 8.

LECTOTYPE (present designation). SENEGAL: sex undetermined; MK. [illegible] Seneg.; n.s. 1893 majusculus Cand. Senegal [Candèze, blue border]; Collection E. Candèze; Hemicleus majusculus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

The description was not published in 1893.

AGRYPNUS Eschscholtz [p. 113]

The relationships of the genus are discussed in the Appendix, p. 251.

SPECIES INCLUDED IN THE GENUS [p. 119]. Of the 413 (not 409) species included in the genus by Hayek (1973) one (*acerbus* Candèze) is transferred to *Adelocera* and four are placed in synonomy. Ninety-one additional species are now included in the genus making a total of 499 species.

Agrypnus aberdarensis (Fleutiaux) [p. 119]

Additional paralectotype examined. 1 ex., same locality as lectotype, with Fleutiaux' determination label (NR, Stockholm).

Agrypnus abreptus (Candèze) [p. 119]

Additional syntypes examined. INDIA: 1 ex., Belgaum P.; n. sp. 1893 abreptus Cand., Bombay. Andr. [Cand., yellow border]; Collection E. Candèze; Lacon abreptus Cand., det. E. Candèze [IRSNB curatorial label]. 1 ex., Kanara; Collection E. Candèze; paratype (IRSNB, Brussels).

Agrypnus acerbus (Candèze) [p. 120]

See *Adelocera acerbus* (Candèze), p. 189.

Agrypnus acervatus (Candèze) [p. 120]

Syntypes examined. BURMA: 1 ex., Tenasserim, Plapoo. Fea Apr. 1887; Lacon acervatus Cand. [? Cand.]; Collection E. Candèze; Lacon acervatus, det. E. Candèze [IRSNB curatorial label]

(IRSNB, Brussels). 1 ex., Tenasserim, Plapoo, Fea Apr. 1887; acervatus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* Candèze, p. 189]. (MCSN, Genoa).

Agrypnus acutangulus (Fleutiaux) [p. 121]

Paralectotype examined. CHINA: ♀, Kina S. Kansu; Sven Hedins Exp. Centr. Asien. Dr. Hummel 28.9.30; Compsolacon acutangulus Fleut., comparé au type [Fleut.] (NR, Stockholm).

Agrypnus adeloceroides (Candèze) [p. 121]

LECTOTYPE (present designation). EQUATORIAL GUINEA: sex not determined, Benito, Congo Franç.; n. sp. 1898 [sic] adeloceroides Cand. [Cand., blue border]; Collection E. Candèze; Tilotarsus adeloceroides Cand. det. E. Cand. [IRSNB curatorial label]; Type (IRSNB, Brussels).

Paralectotypes. EQUATORIAL GUINEA: 2 ex., Benito, Congo Franç. bearing Fleutiaux' determination labels (MNHN, Paris).

Agrypnus adustus (Elston) [p. 121]

Syntypes examined. AUSTRALIA: 1 ♂, 1 ♀ [on one card]; Coen River, Queensland; adustus Elston, co-type. 2 ♂, Mlanda; Queensland Mjoberg; adustus Elston co-type variety (NR, Stockholm). The NR, Stockholm presumably acquired these specimens as a gift or by exchange.

Agrypnus albitactus (Candèze) [p. 123]

Paralectotype. NIGERIA: ♂, Old Calabar; albitactus Cdz. Calab. [Cand., blue border]; Collection E. Candèze; Lacon albitactus Cand., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus alboguttatus (MacLeay) **comb. n.**

Lacon alboguttatus MacLeay, 1888 : 1238.
Lacon alboguttatus MacLeay; Neboiss, 1956 : 4.

LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Austr.; Lacon albogattatus MacL. King's Sound N.W. Aust. [MacLeay] (ANIC, Canberra).

Paralectotypes. AUSTRALIA: 2 ♂, N.W. Austr. (ANIC, Canberra). The aedeagus of the larger specimen is missing.

Elston (1931 : 3) records this species from N.W. Australia: Kimberley District. Two specimens in the NR, Stockholm from this locality determined by Elston are not conspecific with the lectotype. In these specimens the tip of the last visible abdominal sternite is vertical, resembling the transom of a boat, a feature which occurs in many *Agrypuns* species, but not in *alboguttatus* MacLeay.

Agrypnus alboscutatus (Candèze) [p. 124]

Syntype examined. MADAGASCAR: 1 ♂, Madag.; alboscutatus Cand. Lacon alboscutatus Cd., det E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

Agrypnus alternans (MacLeay) **sp. rev., comb. n.**

Lacon alternans MacLeay, 1872 : 251.

LECTOTYPE (present designation). AUSTRALIA: ♂ K 32984 [AM, Sydney number]; Lacon alternans McL. W. Gayndah [MacLeay]; syn of variabilis Id. by A. M. Lea [Lea] (AM, Sydney).

Paralectotype. AUSTRALIA: 1 ex. Gayndah recorded by Hahn (1962 : 80) (CSIRO, Canberra).

The synonymy with *variabilis* Candèze published by Candèze (1891 : 24) and accepted by subsequent cataloguers and workers is not justified.

Agrypnus amamiensis (Miwa) **comb. n.**

Paralacon amamiensis Miwa, 1934 : 248.
Adelocera (*Sabikikorius*) *amamiensis* (Miwa) Ohira, 1967*b* : 101.
Adelocera (*Sabikikorius*) *amamiensis okinawana* Ohira, 1967*b* : 101.

Paralacon amamiensis Miwa. Holotype. JAPAN: sex unknown, Amami-Oshuna; Yakkachi in Sumiyomura 17–VII, 1933 (T. Esaki & K. Yasumatsu) (Entomological Laboratory, Kiushiu University). Not examined.

Paratype. Same locality. Location unknown.

The generic attribution is based on the following specimen: ♂, Hatsuno, Amami-Oshima, 24.vii.1962. Coll. J. Napao: Adelocera amamiensis ♀ (Miwa, 1934) H. Ohira det. 1974 (BMNH),

Adelocera (*Sabikikorius*) *amamiensis okinawana* Ohira. Holotype. JAPAN: ♂, Okinawa (Mt Yonaha), 10.v.1963 H. Nomura (Ohira collection).

Paratypes. JAPAN: 1 ♂, Okinawa (Naha) 1962, K. Kojima. 1 ♂, Okinawa (Yonat) 7.vii.1965 M. Yasui. Location unknown, see Ohira (1967*b* : 95).

Agrypnus anathesinus (Candèze) **comb. n.**

Lacon anathesinus Candèze, 1897 : 10.
Adelocera anathesinus (Candèze) Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). CHINA: ♀, coll. Nonfried, China; n. sp. 94 [sic] anathesinus Cand. Chine [Cand., yellow border]. Collection E. Candèze; Lacon anathesinus Cand., Candèze det. [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus angulicollis (Candèze) [p. 125]

The IRSNB, Brussels possesses 10 specimens from Soerabaia [Surabaja] labelled 'Ex Typis'. One specimen bears in addition Candèze's yellow bordered label; n. sp. angulicollis Cand. Soerabaia. These are presumably the specimens from the eastern part of the island to which Candèze (1891*b* : 143) refers and which are recorded by Van Zwaluwenburg (1959 : 352). They are not part of the original syntype-series.

Agrypnus angulosus (Candèze) **comb. n.**

Lacon angulosus Candèze, 1857 : 117, pl. 2. fig. 17.
Adelocera angulosus (Candèze) Fleutiaux, 1926 : 96.

The description is based on an unrecorded number of specimens 'probablement' from 'Indes-Orientales' (see Hayek, 1973 : 271) received from Dohrn.

Syntype-material. ? IZPAN, Warsaw.

The generic attribution is based on the description and figure.

Agrypnus angusta (Fleutiaux) [p. 125]

Paralectotypes. BURMA: 1 ♂, N.E. Burma, Kambaiti, 7000 ft., 12/5 1934, R. Malaise; Adelocera (Lacon) angusta Fleut. Type [Fleut.]. 1 ♂, same locality but with the date 3–7/5 and without a determination label (NR, Stockholm).

The published height is 2000 m.

Agrypnus apiatus **nom. n.**

Lacon maculosus MacLeay, 1888 : 1283. [Junior primary homonym of *Lacon maculosus* Candèze, 1874.]
Lacon variegatus Schwarz, 1906 : 316. [Replacement name for *Lacon maculosus* MacLeay, 1888.] [Junior secondary homonym of *Lacon variegatus* (Motschulsky, 1854).]
Lacon variatus Schwarz, 1925 : 30. [Replacement name for *Lacon variegatus* Schwarz, 1906.] [Junior primary homonym of *Lacon variatus* Candèze, 1890.]
Agrypnus maculosus (MacLeay) **comb. n.**

LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Austr.; Lacon maculosus MacL. King's Sound N.W. Austr. [MacLeay] (ANIC, Canberra).

Paralectotype. 1 ♀, on the same card mount as the male.

Agrypnus maculosus (MacLeay) is not conspecific with *Agrypnus variabilis* (Candèze) see Hayek, (1973 : 227).

Agrypnus apodixus (Candèze) [p. 126]

Compsolacon apodixus (Candèze) Ohira, 1972*a* : 41.

Paralectotypes examined. PHILIPPINES: 1 ex., Philippines; apodixus Cdz. Philipp. [Cand., yellow border]; Collection E. Candèze; Lacon apodixus Cand., det. E. Candèze [IRSNB curatorial label]; Lacon apodixus Cand. [Fleut.]. 2 ex., labels as above but without Candèze's determination label (IRSNB, Brussels).

The lectotype is 15 mm long compared with the published length of 18 mm. Two paralectotypes are 16 mm and the third 19 mm long.

Agrypnus applanatus (Elston) [p. 126]

Additional syntypes examined. AUSTRALIA: 2 ex. on one card, W. Australia; applanatus Elston co-type (NR, Stockholm). The specimens were presumably obtained as a gift or by exchange.

Agrypnus aquilus (Elston) **comb. n.**

Lacon aquilus Elston, 1927 : 360.
Lacon aquilus Elston; Neboiss, 1956 : 4.

The description is based on an unrecorded number of specimens from AUSTRALIA: Northern Territory, Groote Eylandt (*N. B. Tyndale*).

Syntype-material (see Hayek, 1973 : 274). SAM, Adelaide, AM, Sydney.

The generic attribution is based on the description and Elston's comment that the species is very close to *ferruginous* [sic] Candèze (=*Agrypnus*, see Hayek, 1973 : 154).

Agrypnus arbitrarius (Elston) [p. 126]

Additional syntype examined. AUSTRALIA: ? ♀, Kimberley district; NV. Australia, Myoberg; arbitrarius Elston co-type (NR, Stockholm).

Agrypnus argentatus (Candèze) [p. 127]

Syntypes examined. MADAGASCAR: 1 ex., Tananarivo; n. sp. argentatus Cand. Tananarivo, S. [Cand., blue border]; collection E. Candèze; Lacon argentatus Cand., det. E. Candèze [IRSNB curatorial label]; 12 ex., labels as above but without Candèze's determination label (IRSNB, Brussels).

Agrypnus argillaceus (Solsky) [p. 127]

Lacon argillaceus Solsky, 1871 : 360.
Lacon cinnamomeus Candèze, 1874 : 76. [Synonymized by Fleutiaux, 1918*a* : 191.] [Synonymy confirmed.]
Adelocera (*Sabikikorius*) *argillaceus shirozui* Ohira, 1966*b* : 216.
Agrypnus (*Paralacon*) *argillaceus shirozui* (Ohira) Ohira, 1968*b* : 363. [First publication of new combination.]
Agrypnus cinnamomeus (Candèze), Hayek, 1973 : 139.

Lacon argillaceus Solsky. LECTOTYPE (present designation). U.S.S.R.: ♂, Vladivostock 15 Jul. 1868; Lacon argillaceus mihi [Solsky]; (Z1, Leningrad).

Adelocera (*Sabikikorius*) *argillaceus shirozui* Ohira. Type. TAIWAN: ♂, Alishan (Arisan) 2000 m, C. Formosa 9–iv, 1965 (Entomological Laboratory, Faculty of Agriculture, Kyushu University, Japan). Not examined.

Paratypes. 5 ex., Sungkang, 5–v, 1965; Alishan 9–iv, 1965 (location unknown).

The interpretation of the subspecies is based on: 1 ♂, Taiwan, Tonpogoe, 2500 m, Kagi Ken, 23.3.67 (*T. Shirozu*) determined by Ohira (BMNH).

Agrypnus aristatus (Champion) [p. 127]

Additional syntypes examined. 1 ex., V de Chiriqui, 4000-6000 ft. Champion, Lacon aristatus Ch. [Champion]; aristatus Champ., Chiriqui Ch.; Lacon aristatus Champ. det. Champion [IRSNB curatorial label], 2 ex., V. de Chiriqui, 25–4000 ft. Champion; Lacon aristatus Champ. det. Champion [IRSNB curatorial label]. One specimen bears an additional printed label: Biol. C. Amer. Don. Godman & Salvin. 1 ex., V. de Chiriqui, 2–3000 ft. Champion. 1 ex., Caché, Costa Rica H. Rogers. The last two specimens also bear the following two labels: BCA Coll. III (1) Lacon aristatus Ch. and Biol. C. Amer. Don. Godman & Salvin (IRSNB, Brussels).

Agrypnus asperulatus (Candèze) [p.128]

Lectotype (designated by Van Zwaluwenburg, 1959 : 352). PAPUA NEW GUINEA: sex not determined, N. Guinea, Isola Yule iv.1875 L. M. D'Albertis; TYPE; asperulatus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189]; Lectotype Van Zwaluwenburg (MCSN, Genoa).

The 9 paralectotypes recorded by Van Zwaluwenburg bear the following labels: 3 ex., same locality label as lectotype. 6 ex., N. Guinea, Isola Yule. T. F. v. 1875 L. M. D'Albertis (MCSN, Genoa).

Additional paralectotypes examined. 1 ♀, locality label as lectotype; asperulatus, I. Yule, N. Guinea [? Cand.]. 3 ex., N. Guinea, Isola Yule, T. F. v. 1875 L. M. D'Albertis. All specimens bear Candèze collection and IRSNB curatorial determination labels (IRSNB, Brussels). 3 ex., N. Guinea, Isola Yule, T.F.V. 1875 L. M. D'Albertis. One specimen bears a determination label which seems to be in Candèze's handwriting (NR Stockholm).

Agrypnus assus (Candèze) **comb. n.** [p. 128]

Lacon assus Candèze, 1857 : 145.
Lacon gayndahensis MacLeay, 1872 : 251. [Synonymized by Elston, 1924 : 197.] [Synonymy confirmed.]
Lacon assus Candèze; Hayek, 1973 : 128. [Erroneous combination.]

Lacon gaydahensis MacLeay. LECTOTYPE (present designation). AUSTRALIA: ♂, K32789; Lacon gayndahensis McL.W. [MacLeay] (AM, Sydney).

Paralectotypes. AUSTRALIA: 1 ♂, K32789; L. gayndahensis (AM, Sydney). 1 ♀, Gayndah; Lacon gayndahensis MacL. Gayndah [MacLeay]. 1 ♀, Gayndah (ANIC, Canberra).

The specimens agree well with the description except that the prothorax is distinctly wider than long. The published length is 6½ lines [=13·76 mm if English lines are used]. The lectotype measures 14·2 mm and the paralectotype 12 mm.

Agrypnus atricolor (MacLeay) **comb. n.**

Lacon atricolor MacLeay, 1888 : 1236.
Lacon atricolor MacLeay; Neboiss, 1961 : 7.

LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Aust.; Lacon atricolor MacL. Barrior [sic] Range N.W. Austr. [MacLeay] (ANIC, Canberra).

On MacLeay's determination label the locality is written Barrior Range and the name is recorded in this form by Habu (1962). Froggatt's (1934) account of his 1887 collecting trip to N.W. Australia makes it quite clear that the locality is Barrier Range. This N.W. Australian place name does not appear in any gazetteer. Froggatt describes the King's Sound Pastoral Company's Barrier Range homestead as being 150 miles up the Lennard River and some 15 miles from Mt Percy, one of the highest points in the Oscar Range. The position of the Barrier Range must be approximately 17°30′ S, 125° E.

Agrypnus badeni (Candèze) [p. 129]

Syntypes examined. 1 ♀, Madagascar; n. sp. badeni Cdz. Mad. [Cand., blue border]; Collection E. Candèze; Lacon badeni Cand., det. E. Candèze [IRSNB curatorial label]; 1 ex., same labels but without Candèze's determination label (IRSNB, Brussels).

Agrypnus badius (Elston) **comb. n.**

Lacon badius Elston, 1927 : 350.
Lacon badius Elston; Neboiss, 1956 : 5.

The description is based on an unrecorded number of specimens from AUSTRALIA: S. Australia, Ooldea, Tarcoola (*A. M. Lea*).

Syntype-material (see Hayek, 1973 : 274). SAM, Adelaide, AM, Sydney, NMV, Melbourne.

The generic attribution is based on the description and Elston's comment that the species resembles *arbitrarius* Elston (=*Agrypnus*, see Hayek, 1973 : 126).

Agrypnus beccarii (Candèze) [p. 129]

Agrypnus beccari Candèze; Hayek, 1973 : 129. [Incorrect subsequent spelling.]

Lectotype (designated by Van Zwaluwenburg, 1959 : 352). SUMATRA: ♂, Sumatra, Mts Singalang, Luglio 1878, O. Beccari; Type; beccari [sic] Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189]; Lectotype, Van Zwaluwenburg 1959 (MCSN, Genoa).

Paralectotype. 1 ex., locality label as lectotype; n. sp. beccari [sic] Cdz. Sumatra [Cand., yellow border]; Collection E. Candèze; Lacon beccari [sic] Cand., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus bellator (Elston) **comb. n.**

Lacon bellator Elston, 1927 : 354.
Lacon bellator Elston; Neboiss, 1956 : 5.

The description is based on an unrecorded number of specimens from AUSTRALIA: Northern Territory.

Syntype-material (see Hayek, 1973 : 274). SAM, Adelaide, AM, Sydney.

The generic attribution is based on the description and Elston's comment that the species somewhat resembles *palpalis* Candèze (=*Agrypnus*, see Hayek, 1973 : 195).

Agrypnus bifasciatus (Schwarz) **comb. n.**

Lacon bifasciatus Schwarz, 1902*b* : 312.
Adelocera bifasciata (Schwarz) Fleutiaux, 1926 : 96.

The description is based on an unrecorded number of specimens from Madagascar.

Type-material. ? DEI, Eberswalde.

The generic attribution is based on the description and Schwarz's comment that the species is related to *decoratus* (Candèze) (*Agrypnus* see Hayek, 1973 : 148) and *pictus* (Candèze) (=*Agrypnus*, see p. 232).

Agrypnus biforatus (Candèze) **comb. n.**

Lacon biforatus Candèze, 1895*b* : 55.
Adelocera biforatus (Candèze) Fleutiaux, 1926 : 96.

Syntype examined. MADAGASCAR: 1 ex., Madagascar; n. sp. 94 [sic] biforatus Cand. Madag. [Cand., blue border]; Collection E. Candèze; Lacon biforatus Cand., det. E Candèze [IRSNB curatorial label] (IRSNB, Brussels).

As the description is based on an unrecorded number of specimens collected in N. Madagascar (Diego Suarez and Mont d'Ambre) by Alluaud in 1893, there may be additional material in the MNHN, Paris.

Agrypnus bigranosus (Schwarz) **comb. n.**

Lacon bigranosus Schwarz, 1903*b* : 278.
Adelocera bigranosus (Schwarz) Fleutiaux, 1926 : 96.

The description is based on an unrecorded number of specimens from Madagascar.

The type-material should be in the DEI, Eberswalde but cannot be found there. It must be regarded as lost (Morge, pers. comm.).

The generic attribution is based on the description and Schwarz's comment that *bigranosus* is related to *amplicollis* Boheman (=*Agrypnus*, see Hayek, 1973 : 124).

Agrypnus bimaculatus (Schwarz) **sp. rev., comb. n.**

Lacon bimaculatus Schwarz, 1902*c* : 113.

LECTOTYPE (present designation). AUSTRALIA: ♂, Australia, Victoria; Coll. Schwarz; Typus; bimaculatus Schw. [Schwarz] (DEI, Eberswalde). Length 4 mm.

Paralectotype. ♀, same labels as lectotype but without Schwarz's determination label (DEI, Eberswalde). Length 4·5 mm.

Elston (1924 : 197) synonymized this species with *duplex* Blackburn, 1891. The lectotype of *duplex* is a ♀ and differs in colour and, more importantly, in the puncturation of the pronotum and elytra from the ♀ paralectotype of *bimaculatus* Schwarz. In my opinion these species should be regarded as distinct until the paralectotypes of *duplex* in the AM, Sydney and SAM, Adelaide have been examined.

Agrypnus binus (Candèze) **comb. n.**

Lacon binus Candèze, 1889 : 73.
Adelocera binus (Candèze) Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). INDIA: sex not determined, N. Khasi Godwin Austin; n. sp. binus Cdz. Simla [Cand., yellow border]; Collection E. Candèze; Lacon binus Cand., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

The description is based on an unrecorded number of specimens.

Agrypnus borneoensis (Ohira) **comb. n.**

Compsolacon borneoensis Ohira, 1973*a* : 108, figs 1D, 4H.

Holotype. BORNEO (Sabah): ♂, W. Coast Residency, Ranau 500 m, 28.ix.–7.x.1958 L. W. Quate (BPBM, Honolulu).

Paratypes. BORNEO (Sarawak): 1 ♀, Nanga Pelagus nr Kapit 180–585 m, 7–14.viii.'58; T. C. Maa Collector Bishop (Ohira collection). 1 ♂, 3 ex., recorded by Ohira (location unknown).

Agrypnus brachypterus **nom. n.**

Lacon brevipennis Elston, 1927 : 361.
Agrypnus brevipennis (Elston) **comb. n.** [Junior secondary homonym of *Agrypnus brevipennis* (Schwarz, 1903).]

LECTOTYPE (present designation). AUSTRALIA: ♀, Leigh's Ck., S. Australia, A. H. Elston; Lacon brevipennis Elston Type [Elston]; A. H. Elston Collection (AM, Sydney).

The wings are greatly reduced in length and do not extend beyond the posterior margin of the metathorax.

Agrypnus brevipennis (Schwarz) **comb. n.**

Lobotarsus brevipennis Schwarz, 1903*c* : 44.

LECTOTYPE (present designation). CAMEROUN: ♀, Cameroun; Sjostedt; Type; brevipennis n. sp. Schw. O. Schwarz det. 1902 (NR, Stockholm). Length 9 mm.

Agrypnus bullatus (Carter) **comb. n.**

Lacon bullatus Carter, 1939 : 301.
Lacon bullatus Carter; Neboiss, 1956 : 5.

Holotype. AUSTRALIA: ♀, L. Austin, W. A. H. W. Brown; Lacon bullatus Cart. Type [Carter] (AM, Sydney).

Paratypes. 1 ♂, L. Austin, W. A. H. W. Brown; K. K. Spence Collection; K 67648. 1 ♀, K. K. Spence Collection; K 67648; Lacon bullatus Cart. (AM, Sydney).

The metathorax is short and the wings reduced to short flaps. The elytra appear to be fused together. This species bears a strong resemblance to *Agrypnus deboulayi* (Candèze).

The description is based on four specimens collected by H. W. Brown. Brown presented the holotype to the AM, Sydney and presumably retained some or all of the remainder. I have accepted the two specimens from the K. K. Spence collection as part of the type-series as Brown is known to have given specimens to Spence (G. A. Holloway, AM, Sydney, pers. comm.) and in this case seems to have given him two paratypes. Spence's entire collection is in the AM, Sydney. The whereabouts of the fourth specimen is unknown to me. If Brown retained it, it may be in the NM, Victoria or SAM, Adelaide (G. A. Holloway, AM, Sydney, pers. comm.). If it was in Carter's possession it should be in the ANIC, Canberra (Anderson, 1941 : ii).

Agrypnus buyssoni (Jagemann) **comb. n.**

Lacon buyssoni Jagemann, 1944 : 332.

LECTOTYPE (present designation). CHINA: ♀, Thibet. Coll. Le Moult; Collectio D. E. Jagemann, Moravski Museum Brno; Typus; Lacon buyssoni nov. sp. mihi prope furunculosus Candèze [? Pećirka]; Syntypus; Transcruptio Lacon buyssoni sp. n. E. Jagemann det. (MM, Brno).

Paralectotypes. CHINA: 2 ♀, Thibet, Coll. Le Moult; Lacon buyssoni nov. sp. mihi prope furunculosus Pećerka [Pećirka] Typus (NM, Prague).

Jagemann credits the species to Pećirka in litt.

Agrypnus calamitosus (Candèze) [p. 134]

The IRSNB, Brussels collections contains a single female with the following labels: calamitosus Cdz. Mex. [Cand., green border]. The specimen measures only 8 mm in length compared with the published length of 12 mm and does not agree well with the description.

The specimen in the BMNH recorded by Hayek (1973 : 134) agrees very well with the description and despite the discrepancy in the locality is now selected as the lectotype.

LECTOTYPE (present designation). MEXICO: ♀, Playa Vincente; Mexico, Salle Coll.; ♂; B.C.A. Col. III (1) Lacon calamitosus Cand. [Champ.]; Lacon calamitosus Cand. Salle coll. 1420 (BMNH).

Agrypnus candezei (Fleutiaux) [p. 137]

Additional paralectotype examined. 1 ex., Tonkin, Florentin; Lacon candezei Fleut. [Fleut.]; candezei Fl. Tonkin. Fl. [Cand., yellow border]; Collection E. Candèze; Lacon candezi Fleut. det. Fleutiaux [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus castaneipennis (Candèze) [p. 138]

Lacon castaneipennis Candèze, 1895*b* : 55, [not 1956].

Syntype examined. MADAGASCAR: 1 ex., n. sp. iii. 1893 [sic] castaneipennis Cand. Tananarivo [Cand., blue border]; Collection E. Candèze; Lacon castaneipennis Cand. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus castaneus (Elston) **comb. n.**

Lacon castaneus Elston, 1927 : 385.
Lacon castaneus Elston; Neboiss, 1956 : 6.

The description is based on an unrecorded number of specimens from AUSTRALIA: W. Australia, Roebuck Bay.

Syntype-material (see Hayek, 1973 : 274). SAM, Adelaide, AM, Sydney.

The generic attribution is based on the description and Elston's comment that the nearest congener of the species is *rubiginosus* Candèze (=*Agrypnus*, see Hayek, 1973 : 205).

Agrypnus castelnaui (Candèze) **comb. n.**

Lacon castelnaui Candèze, 1882 : 11.
Adelocera castelnaui (Candèze) Fleutiaux, 1926 : 96.

Syntypes examined. AUSTRALIA (Western Australia): 1 ex., Swan River; n. sp. catelnaui Cdz. Swan River, Cast. [Cand., red border]; Collection E. Candèze; Lacon castelnaui Cand., det. E. Candèze [IRSNB curatorial label]; 1 ♀, 4 ex., with the same labels but without Candèze's determination label (IRSNB, Brussels).

Agrypnus catatonus **nom. n.**

Tilotarsus [sic] *depressus* Candèze, 1882 : 4.
Agrypnus depressus (Candèze) **comb. n.** [Junior secondary homonym of *Agrypnus depressus* (Candèze, 1874)]

Syntypes examined. MADAGASCAR: 2 ex., Madagascar. Collection E. Candèze; Tilotarsus depressus Candèze det. E. Candèze [IRSNB curatorial label]. One specimen bears Candèze's blue bordered label; n. sp. depressus Cdz. Madag. (IRSNB, Brussels).

Agrypnus cinerascens (Candèze) [p. 139]

Lacon cinerascens Candèze, 1878*a* : 103 (not 1879*a*).

Holotype. PAPUA NEW GUINEA: ♂, N. Guinea, Isola Yule, April 1875, L. M. D'Albertis; Type; cinerascens [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Agrypnus cinnamomeus (Candèze) [p. 139]

A synonym of *Agrypnus argillaceus* (Solsky), see p. 208.

Agrypnus cithereus (Candèze) **comb. n.**

Lacon cithereus Candèze, 1893*b* : 9.
Adelocera cithereus (Candèze) Fleutiaux, 1926 : 76.

Syntypes examined. JAVA: 1 ♀, n. sp. cithereus F. Soerabaia [Cand., yellow border]; Collection E. Candèze; Lacon cithereus Cand. det. E. Candèze [IRSNB curatorial label]; length: 10 mm.

1 ♀, 1 ♂, labels as above but without Candèze's determination label and bearing IRSNB paratype labels; length: 11 mm and 9 mm (IRSNB, Brussels).

The published locality is Monts Tengger. This locality is about 40 miles south of Surabaja. Despite the discrepancy in the locality, I have no hesitation in accepting these specimens as syntypes.

In all three specimens the metathorax is reduced in length and the wings do not extend beyond the posterior margin of the second visible abdominal sternite.

Agrypnus coarctatus (Candèze) [p. 140]

Syntype examined. HIMALAYA: 1 ex., Himalaya; coarctatus Cdz. Himalaya [Cand., yellow border]; Collection E. Candèze; Lacon coarctatus Cand., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

The description is based on an unrecorded number of specimens in the Janson collection. No specimens of this species have been found in the BMNH. It is possible that Candèze did not return the material to Janson (see Hayek, 1973 : 271).

Agrypnus coctus (Candèze) [p. 140]

Additional paralectotypes examined. BURMA: 2 ex., Rangoon; Collection E. Candèze; Lacon coctus Cand., det. E. Candèze [IRSNB curatorial label]. One specimen bears Candèze's yellow bordered label: coctus Cdz. Rangoon (IRSNB, Brussels).

Agrypnus coenosus (Hope) [p. 140]

This species was omitted from the Junk catalogue.

The lectotype is 14·5 mm long compared with the published length of 6½ lines (if English lines = 13·5 mm). The Hope Department of Entomology, Oxford possesses a male with a yellow label: coenosus [? Hope] Gen. Hardwicke [printed]. However, as it is 16 mm long I do not consider it to be part of Hope's original series. It is conspecific with the lectotype.

Agrypnus collisus (Candèze) [p. 141]

Syntypes examined. BURMA: 1 ex., Carin Cheba 900–1100 m. L. Fea v.xii.88; collisus Cand. Birmanie, L. Fea [Cand., yellow border]; Collection E. Candèze; Lacon collisus Cand. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels). 1 ex., Carin Cheba 1000–1100 m. L. Fea v.xii. 88; Type collisus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

The description is based on two examples from 'Montagnes de Carin, detroit des Cheba (900–1000) metres'. Designation of the lectotype is deferred until the specimens have been critically examined.

Agrypnus colonicus (Candèze) [p. 141]

Lacon colonicus Candèze, 1882 : 8 [not 1881].
Lacon taciturnus Candèze, 1874 : 60 pars.

LECTOTYPE (present designation). VIETNAM: ♂, Cochinch, illegible word [possibly an abbreviation of Mniszech]; n. sp. colonicus Cdz. Cochinch. [Cand., yellow border]; Collection E. Candèze; Lacon colonicus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

The two syntypes of *Lacon taciturnus* Candèze recorded by Hayek (1973 : 219) are conspecific with *Agrypnus colonicus* (Candèze), but not with the lectotype of *Lacon taciturnus* Candèze (see p. 241).

Agrypnus communis (MacLeay) **comb. n.**

Lacon communis MacLeay, 1888 : 1238.
Lacon communis MacLeay; Neboiss, 1956 : 6.

LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Austr.; Lacon communis MacL. N.W. Austr. [MacLeay]; Lacon communis MacL. Syntype det. Neboiss 1969 (ANIC, Canberra). Paralectotype. AUSTRALIA: 1 ♀, N.W. Austr. (ANIC, Canberra).

The description was published in a paper on the insects collected by Froggatt in the vicinity of King's Sound. Of the other *Lacon* species (e.g. *fasciolatus*) described in the paper, one specimen of each of MacLeay's series bears in addition to the specific name the name of the locality (either King's Sound or Barrier Range) on the determination label. This is not so in the case of *communis*. Whether this is due to an oversight or because the locality was unknown to MacLeay is not known. There are no subsequent records of *communis*.

Agrypnus commutabilis (Elston) [p. 142]

Additional syntypes examined. 3 ex., Noonkanbah; NV. Austr. Mjoberg: Mjoberg; commutabilis Elston Co-type (NR, Stockholm).

Agrypnus compactus (Candèze) **comb. n.**

Lacon compactus Candèze, 1882 : 10.
Lacon compactus Candèze; Neboiss, 1956 : 6.

LECTOTYPE (present designation). AUSTRALIA: Australie septentrionale; n. sp. compactus Cdz. Austr. sept. [Cand., red border]; Collect. Monchicourt; Collection E. Candèze; Lacon compactus Cand., det. E. Candèze (IRSNB curatorial label] (IRSNB, Brussels).

The description is based on an unrecorded number of specimens in the Monchicourt collection, which was acquired by Candèze (see Hayek, 1973 : 271).

Agrypnus comptus (Candèze) [p. 142]

Additional syntype examined. THAILAND: 1 ♀, comptus Cdz. Siam [Cand., yellow border]; Collection E. Candèze; Lacon comptus Cand., det. E. Candèze [IRSNB curatorial label]. 1 ex., Siam; with collection and IRSNB curatorial label as above (IRSNB, Brussels).

Agrypnus consors (Candèze) [p. 142]

Paralectotype. INDIA: 1 ex., Madras; consors Cdz. Madras [Cand., yellow border]; Collection E. Candèze; Lacon consors Cand. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus conspurcatus (Candèze) [p. 143]

Additional paralectotypes examined. MADAGASCAR: 1 ♂, 1 ex., Madagascar Diego Suarez 17 Ch. Alluaud 1893; Collection E. Candèze; Lacon conspurcatus Cand., det. E. Candèze [IRSNB curatorial label]. The male also bears Candèze's blue-bordered label: n. sp. conspurcatus Cand. Mt d'Ambre and a label with the word 'type' in an unknown hand.

The description is based on a number ('plusieurs') of specimens collected by Alluaud 'sur la Montagne d'Ambre, non loin de baie de Diego Suarez'.

Agrypnus corvinus (Candèze) **comb. n.**

Lacon corvinus Candèze, 1882 : 12.
Lacon corvinus (Candèze; Neboiss, 1956 : 6.

LECTOTYPE (present designation). AUSTRALIA (Western Australia): Swan River; n. sp. corvinus Cdz. Swan River Bad [Cand., red border]; Collection E. Candèze; Lacon corvinus Cand., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus costicollis (Candèze) [p. 144]

Agrypnus (*Paralacon*) *costicollis* (Candèze) Ohira, 1971*d* : 205. [First publication of new combination.]

Candèze based the description on a single specimen measuring 16 mm from 'des Indes-Orientales' submitted by Deyrolle. Up to the present time I have been unable to locate a specimen of this size or any other specimen which could be the holotype. Fortunately the species is very distinctive and easily recognized from Candèze's figure. The species occurs in N. India and North Vietnam.

Agrypnus cotesi (Candèze) **comb. n.**

Lacon cotesi Candèze, 1889 : 73.
Adelocera cotesi (Candèze) Fleutiaux, 1926 : 96.

The description is based on an unrecorded number of specimens from 'Bengale'.

Syntype-material. Not located in IRSNB, Brussels or BMNH.

The generic attribution is based on Candèze's comment that the species resembles *piger* Candèze and *truncatus* Herbst which are both now included in *Agrypnus* (Hayek, 1973 : 198 and 223).

Agrypnus crassus (Candèze) **comb. n.**

Lacon crassus Candèze, 1874 : 88.
Lacon crassus (Candèze); Neboiss, 1956 : 7.

The description is based on an unrecorded number of specimens from AUSTRALIA (Queensland): Cape York in the v. Bruk [sic] collection. According to Horn & Kahle (1935 : 38) the E. von Bruck collection was acquired by The University Museum, Bonn in 1882. It seems probable that the collection was lost in the 1939–45 war.

The generic attribution is based on the following specimens: AUSTRALIA: 1 ex., Australia, Somerset, L. M. D'Albertis; [Cand. 1878 : 103 locality], crassus Cdz. Brisb. C.G. [Cand., red border]; Collection E. Candèze; Lacon crassus Cand., det. E. Candèze [IRSNB curatorial label]; 1. 1 ex., Brisbane; Collection E. Candèze; Lacon crassus Cand., det. E. Candèze [IRSNB curatorial label]; 2 (IRSNB, Brussels). Candèze's determination label has obviously been attached to the wrong specimen.

Agrypnus cruentatus (Elston) **comb. n.**

Lacon cruentatus Elston, 1927 : 351.
Lacon cruentatus Elston; Neboiss, 1956 : 7.

The description is based on an unrecorded number of specimens from AUSTRALIA: S. Australia, Lake Callabona (A. Zietz), Oodnadatta. Elston states that the type is in the SAM, Adelaide but he does not record it's locality. Neboiss (1956 : 7) records a paratype in the AM, Sydney. See also Hayek (1973 : 274).

The generic attribution is based on the description and Elston's comments that the species bears a certain resemblance to *pictipennis* Candèze and *guttatus* Candèze. Both these species are now included in *Agrypnus* (Hayek, 1973 : 197 and 161).

Agrypnus davidis (Fairmaire) [p. 147]

LECTOTYPE (present designation). CHINA: ♂, Chine Centrale; Lacon davidii [sic] Fairm. [Fairm.]; Collection E. Candèze; Lacon davidis Fairm. Rev. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

The original spelling is *davidis*. The handwriting on the specimen recorded in Hayek (1973) is not that of Fairmaire. Since there is no means of knowing whether Fairmaire had this specimen before him at the time of the description it should be excluded from the syntype-series.

Agrypnus davidis (Fairmaire) is not conspecific with *Agrypnus argillaceus* (Solsky).

Agrypnus dealbatus (Candèze) [p. 147]

Additional syntypes examined. AUSTRALIA: 1 ex., Cape York; n. sp. dealbatus Cdz. Cap York [Cand., red border]; Collection E. Candèze; Lacon dealbatus Cand., det. E. Candèze [IRSNB curatorial label]. 1 ex., 1 ♀ with the same labels but without Candèze's determination label. The specimens are numbered 1, 2 and 3 (IRSNB, Brussels).

Agrypnus decoratus (Candèze) [p. 148]

Syntypes examined. MADAGASCAR: 2 ex., Madagascar: Collection E. Candèze; Lacon decoratus Cand. det. E. Candèze [IRSNB curatorial label]. One specimen bears in addition: n. sp. decoratus Cand. Madag. [Cand., blue border] (IRSNB, Brussels).

Agrypnus defectus (Candèze) [p. 148]

Syntypes examined. BURMA 1 ♀, Tenasserim, Thagata Fea Apr. 1887; TYPE; defectus [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa). 1 ex., Tenasserim, Kawkareet Fea Maggio 1887; Lacon defectus Cand. [unknown handwriting]; defectus Cand. Tenasserim [Cand., yellow border]; Collection E. Candèze; Lacon defectus Cand., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus delesserti (Candèze) [p. 148]

LECTOTYPE (present designation). INDIA: Neelgh.; n. sp. delesserti Cdz. Neelgheeries [Cand., yellow border]; Lacon delesserti Cand., det. E. Candèze [IRSNB curatorial label] Collection E. Candèze (IRSNB, Brussels).

Agrypnus denticollis (Fleutiaux) [p. 148]

See *Agrypnus tellini* (Fleutiaux) p. 241.)

Agrypnus deyrollei Hayek [p. 149]

The combination *Agrypnus coenosus* (Candèze) was first published by Ohira (1971*d*: 205).

Agrypnus discedens (Candèze) [p. 150]

Syntypes examined. INDONESIA: 1 ex., 2; Ternate Beccari 1875 (MCSN, Genoa). The specimen lacks a determination label but stands beside a specimen bearing a replacement determination label (see *Adelocera acerbus* (Candèze) p. 189). 1 ex., Ternate Beccari 1875; discedens Cdz. Ternate [Cand., yellow border]; Collection E. Candèze; Lacon discenens Cand., det E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

The MCSN, Genoa contains in addition two specimens with the following labels: 1; Molluche, Ternate, Coll. Bruijn 1875; Type; discedens Cand. [unknown hand, similar to labels known to replace Candèze's original labels, see *Adelocera acerbus* (Candèze) p. 189]; Lectotype Van Zwaluwenburg and 3; Molluche, Ternate, Coll. Bruijn 1875. The IRSNB, Brussels also possesses a specimen with the same locality with the Candèze collection and IRSNB curatorial determination labels. The numbers 1–3 were almost certainly affixed by Van Zwaluwenburg but he did not publish a lectotype designation for this species.

A. A. Bruijn accompanied Beccari on his collecting trip aboard the Dutch warship *Soerabaja* in 1875–76 (Gestro, 1876 : 512).

In my opinion neither the Laglaise (Hayek, 1973 : 150) or Bruijn specimens should be regarded as part of the syntype-series.

Agrypnus dorcinus (Candèze) [p. 150]

The combination was first published by Ohira (1972*a* : 40).

Syntypes examined. PHILIPPINES: 2 ex., 1 ♀, Bohol; Collection E. Candèze; Lacon dorcinus Cand., det. E. Candèze [IRSNB curatorial label]. One specimen bears Candèze's yellow-bordered label: dorcinus Bojol [sic] Cdz. (IRSNB, Brussels).

Agrypnus elongatus (Carter) **comb. n.**

Mymodes (?) *elongatus* Carter, 1939 : 302.
Myrmodes (?) *elongatus* Carter; Neboiss, 1956 : 15.

Holotype. AUSTRALIA: ♂, Clermont 12/30. Queensland, K. K. Spence; Holotype; ? Myrmodes elongatus Cart. [Carter] (AM, Sydney).

Carter records that Spence gave him three specimens, but whether this number includes the type is not clear.

The AM, Sydney possesses two specimens from the same locality and with the same date, and a third from the same locality but with the date 1. 29. and Carter's determination label. All bear paratype labels, but I suspect that only the first two are true paratypes. The ANIC, Canberra collection should also be examined (see note on Carter collection, p. 248) in case it contains specimens with a better claim to paratype status.

This species bears a close resemblance to *A. rubiginosus* (MacLeay). In both species the terminal segment of the labial palps is much enlarged.

Agrypnus fairmairei (Candèze) [p. 152]

Syntype examined. MADAGASCAR: 1 ex., Madagascar; fairmairei Cand. Mad., Type [Cand., blue border]; Collection Fairmaire; Collection E. Candèze; Lacon fairmairei Cand., det. E. Candèze [IRSNB curatorial label] Type ? (IRSNB, Brussels).

Agrypnus farinosus (Candèze) [p. 153]

Syntypes examined. TOGO: 3 ex., Togo; Collection E. Candèze, Tilotarsus farinosus Cand. det. E. Candèze [IRSNB curatorial label]. One specimen bears Candèze's blue-bordered label; n. sp. 94 [sic] farinosus Cand. Togo, Kr. and a label with the word 'Type' (IRSNB, Brussels).

Agrypnus fasciolatus (MacLeay) **comb. n.**

Lacon fasciolatus MacLeay, 1888 : 1239.
Lacon fasciolatus MacLeay; Neboiss, 1956 : 8.

LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Austr.; Lacon fasciolatus MacL. King's Sound N.W. Austr. [MacL.] (ANIC, Canberra).

Agrypnus fex (Candèze) [p. 155]

Syntype examined. WEST MALAYSIA: 1 ex., Singapour; fex Cdz. Singap. [Cand., yellow border]; Lacon fex Cd. det. E. Candèze (IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

The specimen agrees well with the description. It would appear that Candèze retained the specimen instead of returning it to Janson.

Agrypnus fictus (Candèze) [p. 155]

Lacon fictus Candèze, 1878*b* : LIII (7) [not 1868*b*].

Syntype examined. MADAGASCAR: ♀, Madagascar; fictus Cdz. Mad.; Lacon fictus Cd., det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

Agrypnus froggatti (MacLeay) **comb. n.**

Lacon froggatti MacLeay, 1888 : 1234.
Lacon froggatti MacLeay; Neboiss, 1961 : 8.

LECTOTYPE (present designation). AUSTRALIA: ♀, N.W. Aust. Lacon froggatti MacL. Barrior Range N.W. Aust. [MacLeay] (ANIC, Canberra).

For a note on the locality see *Agrypnus atricolor* (MacLeay) p. 209.

Agrypnus gabonensis Hayek [p. 158]

Syntype examined. GABON. 1 ex., Gabon; n. sp. reductus Cdz. Gabon. C. [Cand., blue border]; Lacon reductus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

Agrypnus geminatus (Candèze) [p. 158]

Additional syntypes examined. AUSTRALIA: 3 ex., Australie; Lacon geminatus Cd., det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. One specimen bears Candèze's red-bordered label: geminatus Cdz. Austr. (IRSNB, Brussels).

Agrypnus gibbosus (Schwarz) **comb. n.**

Lacon gibbosus Schwarz, 1903*b* : 379.
Adelocera gibbosus (Schwarz) Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). AUSTRALIA: ♂, N. Queensland E. Weiske; Coll. Schwarz; Typus (DEI, Eberswalde). Length 10 mm.

Paralectotype. ♀, with the same labels as the lectotype (DEI, Eberswalde). Length 9 mm.

Neither specimen bears a Schwarz determination label but I have no doubt that these specimens are part of the original series. As the size range is given as 10–14 mm there may be additional paralectotypes elsewhere.

Agrypnus gibbus (Candèze) [p. 159]

Syntype examined. AUSTRALIA (Queensland): 1 ex., Cleveland Bay; n. sp. gibbus Cdz. Aust. Sept. [Cand., red border]; Collection E. Candèze; Lacon gibbus Cand. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus girardi **nom. n.**

Archontas pauliani Girard, 1970 : 28.
Agrypnus pauliani (Girard) Hayek, 1973 : 197. [Junior secondary homonym of *Agrypnus pauliani* (Fleutiaux, 1941).]

Agrypnus glirinus (Candèze) [p. 159]

Lacon glirinus Candèze, 1865 : 11.
Lacon stricticollis Fairmaire, 1881 : 226. **Syn. n.**
Agrypnus stricticollis (Fairmaire) Hayek, 1973 : 216.

Lacon stricticollis Fairmaire. LECTOTYPE (present designation). FIJI Is.: ♀, Viti 81 : 51 [BMNH registration number=purchased of Godeffroy Museum, Hamburg, 1881]; Lacon sticticollis [sic] Fairm. (unknown handwriting) (BMNH).

Paralectotypes. FIJI Is.: 1 ♂, Viti : 81 : 50 (BMNH). 1 ♀, C. Fairm.; Lacon stricticollis Fairm. I. Viti [? Fairm.]; Lacon stricticollis Frm. E. Fleutiaux vid. 1932; stricticollis Frm. Viti [Cand., red border] (IRSNB, Brussels).

Agrypnus goudotii (Candèze) [p. 159]

Syntype examined. MADAGASCAR: 1 ♀, Madagascar; goudotii Cdz. Mad. [Cand., blue border]; Collection E. Candèze; Lacon goudotii Cand. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels). The specimen is 25 mm long. The IRSNB collection also contains 3 ♀ from the Candèze collection measuring 21, 22 and 23 mm. No males from the Candèze collection have been located.

Agrypnus gracilentus (Schwarz) [p. 160]

LECTOTYPE (present designation). SOLOMON Is.: ♂, Tulagi Salomon Is.; Coll. Bennigsen (DEI, Eberswalde).

Paralectotypes. SOLOMON Is.: 1 ♀, Tulagi, Salomon Is.; Coll. v. Bennigsen. 1 ♂, 1 ♀, Tulagi Salomon Is., Coll. Schwarz. The female bears Fleutiaux' label '? type de gracilentus=gracilis Cand. (DEI, Eberswalde).

None of the specimens bear Schwarz's determination label but as all bear the red 'Typus' labels characteristic of the Schwarz collection I have no hesitation in accepting them as Schwarz's original material.

Whether the locality Tulagi refers to the town on Nggela in the Floral Island group or to the island of that name lying off the south coast of Nggela is not known.

Van Zwaluwenburg (1947 : 110), discussing *gracilis* Candèze, refers to the 'synonymous *gracilentus*' but to the best of my knowledge this synonymy has not been confirmed. Fleutiaux seems to have been undecided on whether the species are conspecific.

Examination of the syntype-series and specimens standing as *gracilis* in the BMNH and other collections suggests that this species shows a wide range of variation not only in external appearance but also in the shape of the aedeagus. Until this problem has been resolved I believe that *gracilentus* Schwarz should be treated as a good species.

Agrypnus gracilis (Candèze) [p. 160]

Compsolacon gracilis var. *specularis* Van Zwaluwenburg, 1947 : 109.

Lacon gracilis Candèze. Additional syntypes examined. PAPUA NEW GUINEA: 1 ♀ N. Guin. Allemande. Also 2 ♂, 1 ♀ Nouvelle Guinée and 1 ♂, 1 ♀ N. Guinea, Amberbaki [position unknown]. All the specimens bear, in addition to the IRSNB curatorial and determination labels; Lacon gracilis det. E. Candèze and Lacon gracilis Cd. rev. E. Fleutiaux (IRSNB, Brussels). Despite the fact that the specimens lack Candèze's determination labels I have no doubt that they formed part of his original series.

This species seems to show a wide range of variation. See also the comments under *A. gracilentus* Schwarz above.

Compsolacon gracilis specularis Van Zwaluwenburg, 1947 : 109. Holotype. WEST IRIAN: ♀, Hollandia, Dutch New Guinea, April (*Borys Malkin*) (USNM, Washington, type no. 58272). Not examined.

Paratypes. 5 ♀ (probable) same data as type (USNM, Washington). Not examined.

The 1972 amendment to the ICZN Article 45(e)(i) requires that the term variety used before 1961 be interpreted as denoting subspecific rank.

Examination of the syntype and other specimens standing as *gracilis* in the BMNH collections (a number bear Van Zwaluwenburg's determination labels) suggests that *gracilis* in its present interpretation is a very variable species or possibly a group of sibling species. The status of *specularis* can probably be elucidated only in the course of a thorough study of the New Guinea *Agrypnus* species.

Agrypnus granulatus (MacLeay) [p. 161]

Lacon granulatus MacLeay, 1872 : 251.
Lacon insignitus Candèze, 1874 : 89. **Syn. n.**
Agrypnus insignitus (Candèze); Hayek, 1973 : 168.

Lacon granulatus MacLeay. LECTOTYPE (present designation). AUSTRALIA: ♀, K 32790; Lacon granulatus MacL. W. Gayndah [MacLeay] (AM, Sydney).

Paralectotypes. 1 ♀, K 32790 (AM, Sydney). 3 ♂, 1 ♀ on one card, Gayndah, Lacon granulatus MacL. Gayndah [MacLeay]. 1 ♀, same labels; on permanent loan from MacLeay Museum, University of Sydney (ANIC, Canberra). This specimen is not recorded by Hahn.

Agrypnus guttatus (Candèze) [p. 161]

Lacon guttatus Candèze, 1857 : 151.
Lacon maculatus MacLeay, 1872 : 251. [Synonymized by Lea, 1920 : 397.] [Synonymy confirmed.]
Agrypnus maculosus (MacLeay); Hayek, 1973 : 180. [Incorrect subsequent spelling.]

Lacon maculatus MacLeay. LECTOTYPE (present designation). AUSTRALIA: ♀, 32791; Lacon maculatus Mch. W. Gayndah [MacLeay]; Syn. of guttatus Cand. Id. by A.M. Lea [lea] (AM, Sydney).

Agrypnus gypsatus (Candèze) [p. 162]

Additional syntypes examined. BURMA: 4 ♀, 1 ♂, Carin Cheba, 900–1100 m. L. Fea v xii 88. One female bears in addition: Typus; gypsatus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189]. (MCSN, Genoa). 1 ♀, same locality; L. gypsatus Cdz. sp. n. [Candèze], 1 ♂ same locality (MNHN, Paris), 1 ♀, 1 ♂ same locality; Collection E. Candèze; Lacon gypsatus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB Brussels).

Agrypnus hackeri (Elston) **comb. n.**

Lacon hackeri Elston, 1927 : 357.
Lacon hackeri Elston; Neboiss, 1956 : 9.

The description is based on an unrecorded number of specimens from AUSTRALIA: Queensland, Stradbroke Island (*H. Hacker*); New South Wales, Sydney.

Syntype-material (see Hayek, 1973 : 274). QM, Brisbane, AM, Sydney.

The generic attribution is based on the description and Elston's comment that the species resembles *pleureticus* Candèze (=*Agrypnus*, Hayek, 1973 : 200).

Agrypnus hamatus (Candèze) **comb. n.**

Lacon hamatus Candèze, 1893*b* : 8.
Adelocera hamatus (Candèze) Fleutiaux, 1926 : 96.

Syntypes examined. MADAGASCAR: 1 ♂, 1 ex., Madagascar; Collection E. Candèze; Lacon hamatus Cand. det. E. Candèze [IRSNB curatorial label]. The male, which is 12 mm long compared to the published length of 9 mm, also bears the following labels: hamatus Cand., Madagascar [Cand., blue border]; Type [manuscript] (IRSNB, Brussels).

Agrypnus hexagonus (Candèze) [p. 163]

Syntypes examined. MADAGASCAR: 6 ex., Tananarivo; Collection E. Candèze; Tilotarsus hexagonus Cand. det. E. Candèze [IRSNB curatorial label], One specimen bears the following additional labels: Type hexagonus Cand. Tananarivo [Cand., blue border]; Type (IRSNB, Brussels). The published length is 12 mm. The specimen with Candèze's determination label is 13 mm long, the others vary between 11·5 mm and 13 mm. The published locality is Antananarivo. Tananarivo is an alternative spelling.

Agrypnus himalayanus (Jagemann) **comb. n.**

Compsolacon himalayanus Jagemann, 1944 : 335.

LECTOTYPE (present designation). CHINA. ♀, Poo [position unknown]; West.-Hym. Coll. Splichal; Compsolacon himalayanus Jg. det. Jagemann. Typus; [Jagemann] (NM, Prague). Length 15·5 mm.

Paralectotype. ♀, same locality and determination label as lectotype (NM, Prague). Length 14 mm.

Agrypnus holosericeus (Candèze) [p. 164]

Additional syntypes examined. INDIA. 2 ♂, 5 ex., Kanara; Collection E. Candèze; Lacon holosericeus Cand. det. E. Candèze [IRSNB curatorial label]. One specimen bears an additional label: n. sp. 1893 holosericeus Bombay Andr. [Cand., yellow border] (IRSNB, Brussels). 1 ex., Kanara; holosericeus Cand. [Andrews] co-type [BMNH curatorial] (NR, Stockholm).

Agrypnus hunti **nom. n.**

Lacon farinosus Elston, 1927 : 355.
Lacon farinosus Elston; Neboiss, 1956 : 7.
Agrypnus farinosus (Elston) **comb. n.** [Junior secondary homonym of *Agrypnus farinosus* (Candèze, 1895).]

Type-material (see Hayek, 1973 : 274). SAM, Adelaide, AM, Sydney.

Syntype examined. AUSTRALIA: 1 ♂, Port Darwin, N. Territory; Lacon farinosus Elston Co-Type [Elston]: A. H. Elston Collection (AM, Sydney).

Agrypnus hydropictus (Fairmaire) **comb. n.**

Lacon hydropictus Fairmaire, 1880 : 283.
Adelocera hydropictus (Fairmaire) Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). REUNION: ♀, Ile Reunion; C. Fairm.; Lacon hydropictus Fairm. [Fairm.]; hydropictus Fairm. Reunion [Cand., blue border] Type; Collection E. Candèze; Lacon hydropictus Fairm. det. Fairmaire [IRSNB curatorial label]; Type unique de Lacon hydropictus Fairm. Fleut. vidit. 1920 [Fleut.] (IRSNB, Brussels). Fairmaire did not record the number of specimens on which he based his description.

Agrypnus impressus (Candèze) [p. 166]

Lectotype (designated by Van Zwaluwenburg, 1959 : 353). WEST IRIAN: ♂, N. Guinea, Andai Beccari 1875; Type. impressus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189]; Lectotype, Van Zwaluwenburg (MCSN, Genoa).

Paralectotype. 1 ♂, same locality as lectotype (MCSN, Genoa).

The lectotype is 12·5 mm long and the paralectotype 13·5 mm long compared with the published length of 15 mm.

Agrypnus inaequalis (Fleutiaux) [p. 166]

Additional paralectotype examined. MADAGASCAR: 1 ♀, Fianarantsoa, Madagascar; Collection Fleutiaux; Adelocera inaequalis Fleut. [Fleutiaux] (IRSNB, Brussels).

Agrypnus incultus (MacLeay) **comb. n.**

Lacon incultus MacLeay, 1888 : 1235.
Lacon incultus MacLeay; Neboiss, 1961 : 8.

LECTOTYPE (present designation). AUSTRALIA: ♀, N.W. Aust.; Lacon incultus MacL. Syntype det. Neboiss [Neboiss]; Lacon incultus MacL. King's Sound, N.W. Aust. [MacLeay] (ANIC, Canberra).

Paralectotype. AUSTRALIA: ♀, N.W. Aust.; Lacon incultus MacL. Syntype det. Neboiss [Neboiss] (ANIC, Canberra).

The third specimen recorded by Hahn (1962 : 81) has not been found.

Agrypnus inductus (Candèze) [p. 167]

Holotype. BURMA: sex undetermined. Bhamo, Birmania Fea vi. 1885; inductus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Agrypnus indutissimus (Candèze) [p. 167]

Holotype. ENGGANO: ♀, Engano, Kifu – juc v. [sic] Modigliani 1891; Type; indutissimus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Agrypnus inflatus (Candèze) [p. 168]

Syntypes examined. INDIA: 2 ♀, illegible round label [? Davis, Inde]; Mysore; Collection E. Candèze; Lacon inflatus Cand., det. E. Candèze [IRSNB curatorial label]. One specimen bears in addition: n. sp. 1893 inflatus Cand. Indus [?] [Cand., yellow border] (IRSNB, Brussels). It seems reasonable to regard the specimen in the MNHN, Paris as a syntype (Hayek, 1973 : 168).

Agrypnus insignitus (Candèze) [p. 168]

See *Agrypnus granulatus* (MacLeay) p. 221.

Agrypnus insulsus (Candèze) [p. 169]

Candèze does not record a locality for this species. The paper is based mainly on material collected by Alluaud around Diego Suarez and on Mont d'Ambre but as other localities are also recorded it seems reasonable to accept the following specimens as syntypes.

Syntypes examined. MADAGASCAR: 1 ex., Tananarivo [2 mss. labels]; n. sp. 1893 insulsus Cand. Tananarivo [Cand., blue border]. Type; Lacon insulsus Cd., det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze, 7 ex., same labels but without Candèze determination label (IRSNB, Brussels).

Agrypnus jansoni (Fairmaire) [p. 171]

Syntype examined. MADAGASCAR: 1 ex., Madagascar [? Coquerel] Lacon jansoni Fairm., Madag. [Fairm.]; C. Fairm.; jansoni Fairm. Madag. [Cand., blue border]; Type; Collection E. Candèze; Lacon jansoni Fairm. det. Fairmaire [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus kawamurae (Miwa) **comb. n.**

Lacon kawamurae Miwa, 1929 : 230.

Syntypes. TAIWAN: 2 ♂, 2 ♀, Horisha, v–viii (*H. Kawamura*) (? Taiwan Ag. Research Institute, Taipei). Not examined.

The generic attribution is based on the following specimen determined by Dr H. Ohira and kindly presented by him to the BMNH: 1 ♂, Formosa, Nanshanoi 15.v.1971 (*C. Tou*).

Agrypnus lachrymosus (Candèze) [p. 173]

Additional paralectotypes examined. AUSTRALIA (Victoria): 3 ex., Melbourne; Collection E. Candèze; Lacon lachrymosus Cand., det. E. Candèze (IRSNB curatorial label). One specimen, which has lost its abdomen, bears Candèze's blue bordered label: lachrymosus Cdz. Melb. (IRSNB, Brussels).

Agrypnus latiusculus (Candèze) [p. 175]

Syntype examined. MADAGASCAR: 1 ♂, Madagascar; n. sp. latiusculus Cdz. Madag. [Cand., blue border]; Collection E. Candèze; Lacon latiusculus Cand., det. E. Candèze; Type (IRSNB, Brussels).

Agrypnus laxatus (Candèze) [p. 176]

Additional paralectotypes examined. MADAGASCAR: 2 ex., Madagascar Diego Suarez 7 Ch] Alluaud. 1893; Lacon laxatus Cand. det. E. Candèze (IRSNB curatorial label); Collection E. Candèze. One specimen bears Candèze's blue bordered determination label: n. sp. 1894 [sic. laxatus Cand., Mad., All. (IRSNB, Brussels).

The date on Candèze's determination label on the lectotype is 1895, not 1893.

Agrypnus lecordieri (Girard) **comb. n.**

Lobotarsus lecordieri Girard, 1971 : 566, figs 12, 14.

Holotype. IVORY COAST : ♂ Lamto I., 5.4–25.5.1965, Ch. Lecordier, à la lumière (MNHN, Paris). Not examined. The generic attribution is based on the figure and Girard's comment that it may be compared with *simplex* Candèze (=*Agrypnus*, see Hayek, 1973 : 212).

Agrypnus leucaspis (Candèze) [p. 176]

Additional syntypes examined. WEST MALAYSIA: 2 ex., Malacca; Lacon leucaspis Cand., det. E. Candèze; Collection E. Candèze. One specimen bears Candèze's yellow-bordered determination label: leucaspis Cdz. Malac. (IRSNB, Brussels). 1 ♀, standing as *leucaspis*: Malacca; D. Candèze (MCSN, Genoa).

Agrypnus libellus (Candèze) **comb. n.**

Lacon libellus Candèze, 1893*c* : 170.
Adelocera libellus (Candèze) Fleutiaux, 1926 : 96.

Holotype. INDIA (Mysore): ♂, Mars 1893 libellus Cand. Kanara; Lacon libellus Cand. det. E. Candèze (IRSNB, curatorial label); Collection E. Candèze; Type (IRSNB, Brussels).

Agrypnus limosus (Candèze) [p. 177]

Syntypes examined. NEW GUINEA: 2 ex., Nouvelle Guinea; Lacon limosus Cand., det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. One specimen bears Candèze's yellow bordered label: n. sp. limosus Cdz. Nov. Guin. (IRSNB, Brussels).

Candèze gives the locality as 'Nouvelle-Guinée' without further details.

Agrypnus lindensis (Blackburn) [p. 177]

Additional paralectotype examined. 1 ex., standing over a label: lindensis Blackb. D. Blackb. 93. with the number 891 on the card mount (MCSN, Genoa).

The IRSNB, Brussels collection contains a specimen with the following labels: lindensis Blackb. Adelaide [Cand., red border]; Blackburn; Type; Collection E. Candèze; Lacon lindensis Bl. det. Blackburn (IRSNB curatorial label). As Adelaide is some distance from Port Lincoln, the published locality, this specimen is not accepted as a syntype.

Agrypnus lineatellus (MacLeay) **comb. n.**

Lacon lineatellus MacLeay, 1888 : 1236.
Lacon lineatellus (MacLeay); Neboiss, 1961 : 9.

LECTOTYPE (present designation). AUSTRALIA: ♀, N.W. Aust.; Lacon lineatellus MacL. Barrior [sic] Range, N.W. Aust. [MacLeay] (CSIRO, Canberra). Length 10·8 mm.

Paralectotype. AUSTRALIA: 1 ♂, N.W. Aust. (CSIRO, Canberra). Length 9 mm compared with the published length of 5 lines (=10·6 mm). For a note on the locality see *Agrypnus atricolor* (MacLeay) p. 209.

Agrypnus litigiosus (Candèze) **comb. n.**

Lacon litigiosus Candèze, 1874 : 73.
Adelocera litigiosus (Candèze) Fleutiaux, 1926 : 96.

Syntype examined. WEST MALAYSIA: 1 ex., Malacca; litigiosus Cdz. Malac. [Cand., yellow border]; Collection E. Candèze; Lacon litigiosus Cand., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels). The abdomen and right elytron are missing.

The description is based on an unrecorded number of specimens in the Janson collection. As no specimen can be found in the BMNH, it must be assumed that Candèze did not return the material to Janson.

Agrypnus longicollis (Heller) **comb. n.**

Lacon longicollis Heller, 1914 : 640, pl. 16, fig. 3.
Adelocera longicollis (Heller); Fleutiaux, 1926 : 96.

The description is based on 11 specimens (Heller, 1914 : 618) collected in WEST IRIAN: Merauke in 1904–5 by the Netherlands Expedition to New Guinea.

Syntypes. ? ZM, Amsterdam, not confirmed.

The generic attribution is based on the description and figure.

Agrypnus luctuosus (Candèze) **comb. n.**

Lacon luctuosus Candèze, 1893*c* : 171.
Adelocera luctuosus (Candèze); Fleutiaux, 1926 : 96.

Holotype. INDIA (Mysore): ♀, Kanara; Mars 1893, luctuosus Cand. Kanara A. [Cand., yellow border]; Collection E. Candèze; Lacon luctuosus Cand., det. E. Candèze; Type (IRSNB, Brussels).

Agrypnus lustratus (Candèze) [p. 179]

Additional syntype examined. INDIA: 1 ex., Nagpoor; n. sp. lustratus Cand., Beng. P. Cand. [Cand., yellow border]; Collection E. Candèze; Lacon lustratus Cand., det. E. Candèze [IRSNB, curatorial label] (IRSNB, Brussels).

Agrypnus macleayi (Candèze) **comb. n.**

Lacon macleayi Candèze, 1882 : 11.
Lacon macleayi Candèze; Neboiss, 1956 : 10.

The description is based on an unrecorded number of specimens from AUSTRALIA: Queensland, Port Denison.

No syntype-material has been found in the BMNH or IRSNB, Brussels (see Hayek, 1973 : 271).

The generic attribution is based on Candèze's comment that the species resembles *princeps* Candèze (=*Agrypnus*, Hayek, 1973 : 201).

Agrypnus maculatus (MacLeay) [p. 180]

Agrypnus maculosus (MacLeay); Hayek, 1973 : 180. [Incorrect subsequent spelling.] See *Agrypnus guttatus* (Candèze) p. 221.

Agrypnus maculipennis (Schwarz) **comb. n.**

Lobotarsus maculipennis Schwarz, 1903*a* : 361.

Syntypes examined. MADAGASCAR: 1 ♂, 1 ♀ Madagascar; Coll. Schwarz; maculipennis Schw. [Schwarz]; cotypus. The ♂ bears an additional label: suboculatus Cand. [Fleut.] (DEI, Eberswalde). The synonymy has not been published and in my opinion is not justified.

Agrypnus maculosus (Candèze) [p. 180]

Agrypnus maculatus (Candèze); Hayek, 1973 : 180. [Incorrect subsequent spelling.]

Agrypnus madurensis (Candèze) **comb. n.**

Lacon madurensis Candèze, 1893*c* : 171.
Adelocera madurensis (Candèze) Fleutiaux, 1926 : 96.

Holotype. INDIA: ♂, Madura [Madurai]; n. sp. 1893 madurensis Cand. Madura, Andr. [Cand., yellow border]; Collection E. Candèze; Lacon madurensis Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Candèze records that the specimen was found by C. Somers-Smith. This gentleman was a private collector who gave material to his friend H. E. Andrews (Andrews, 1929 : vii). This may explain why Candèze's label bears the name 'Andr.'.

Agrypnus mansuetus (Blackburn) [p. 180]

The IRSNB, Brussels contains a specimen from the Blackburn collection bearing Candèze's red-bordered determination label and a type label. As this specimen bears the locality Adelaide (in S. Australia, about 750 miles SW. of the published locality Narrabri) it cannot be accepted as part of Candèze's original material.

Agrypnus marginatus (Candèze) [p. 181]

Additional paralectotype examined. AUSTRALIA (New South Wales): 1 ex., Clarence River; D. Candèze (MCSN, Genoa). The specimen lacks a determination label but stands under *marginatus* Candèze in the collection.

Agrypnus marginipennis (Schwarz) **comb. n.**

Lacon marginipennis Schwarz, 1903*b* : 380.
Lacon marginipennis (Schwarz); Neboiss, 1956 : 10.

The description is based on an unrecorded number of specimens from 'Sud Australian'.

Type-material. DEI, Eberswalde according to Neboiss (loc. cit.).

The generic attribution is based on Schwarz's comment that the species is related to *pleureticus* (Candèze) (=*Agrypnus*, see Hayek, 1973 : 200).

Agrypnus marmoratus (Candèze) [p. 181]

Paralectotypes. AUSTRALIA: 1 ex., marmoratus Cdz. A. Queensl. [Cand., red border]; Collection E. Candèze; Lacon marmoratus Cand., det. E. Candèze [IRSNB curatorial label]. 2 ex., Queensland; Collection E. Candèze; Lacon marmoratus Cand., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus miser (Schwarz) **comb. n.**

Lobotarsus miser Schwarz, 1905*b* : 281.

Syntype examined. GABON. 1 ♀, Gabon; coll. Schwarz; Cotypus; miser Schwarz [Schwarz] (DEI, Eberswalde).

Agrypnus mixtus (Candèze) [p. 183]

Holotype. BURMA: sex undetermined, Tenasserim, Kawkareet, Fea, Maggio 1887; Typus; mixtus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Agrypnus miyamotoi (Nakane & Kishii) [p. 183]

Colaulon (*Cryptolacon*) *miyamotoi ihai* Ohira, 1967*b* : 104.
Agrypnus miyamoti (Nakane & Kishii); Hayek, 1973 : 183. [Incorrect subsequent spelling.]

Colaulon (*Cryptolacon*) *miyamotoi ihai* Ohira. Holotype. JAPAN Ryuku Islands: ♀, Ie-jima near Okinawa, 10–11 1956, K. Iha (Ohira collection). Not examined.

Agrypnus mjobergi (Elston) [p. 184]

LECTOTYPE (present designation). AUSTRALIA: sex undetermined, Cedar Creek, Queens. Mjoberg; Type; mjobergi Elston, Type (NR, Stockholm).

Paralectotype. 1 ex., Cedar Creek; Queensl. Mjoberg; mjobergi Elston Co-type (NR, Stockholm).

Agrypnus modestus (Candèze) [p. 184]

Lacon modestus var. *major* Fleutiaux, 1889 : 139. [Synonymized by Fleutiaux, 1927 : 26.]

Lacon modestus var. *major* Fleutiaux. LECTOTYPE (present designation). VIETNAM (SOUTH): ♀ Tr; 13; Lacon modestus v. major Tourane Annam; modestus v. major Fleut. Ann. Soc. Ent. Fr. 89: 139 [Fleut.]; modestus vu coll. Cand. Bruxelles 1923 [Fleut.] (MNHN, Paris).

The published locality and collector is Tourane, Perraudiere.

Agrypnus molitor (Candèze) [p. 185]

Syntypes examined. PHILIPPINES: 2 ♂, Mindang [illegible]; Collection E. Candèze; Lacon molitor Cd. det. E. Candèze [IRSNB, curatorial label] (IRSNB, Brussels). These two specimens are 15 mm long, the published length. Candèze's yellow-bordered label 'molitor Cdz. Mindan.' is attached to a female measuring 21 mm bearing the locality label 'Palawan Strand'. It seems reasonable to assume that it was transferred to this specimen by mistake.

Agrypnus monachus (Candèze) **comb. n.**

Lacon monachus Candèze, 1882 : 12.
Lacon monachus Candèze; Neboiss, 1956 : 10.

Syntypes examined. AUSTRALIA (New South Wales): 1 ex., Australia, Mt. Victoria, N.S. Wales, D'Albertis, 73; n. sp. monachus Cdz. M. Victoria [Cand., pink border]; Lacon monachus Cand., det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze; Type (IRSNB, Brussels). 1 ex., same locality, also labelled type; monachus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Agrypnus montanus (Miwa) **comb. n.**

Lacon montanus Miwa, 1929 : 229.

Syntypes. TAIWAN: 1 ♂, Shinchiku, 1–vii, 1918 (*J. Sonan & K. Miyake*). 1 ♀, Baibara, 15–viii, 1926 (*Miwa*). Not examined.

Dr Ohira has informed me (pers. comm., February, 1975) that he was unable to locate the type-material in the Taiwan Agricultural Research Institute, Taipei where much of Miwa's material is preserved. The generic attribution is based on the following specimen: 1 ♀, Formosa, Kappanzan vi. 20. 1941. K. Ohbayashi (Ohira collection).

Agrypnus morosus (Candèze) **comb. n.**

Tilotarsus [sic] *morosus* Candèze, 1895*a* : 48.
Lobotarsus morosus (Candèze); Schwarz, 1906 : 30.

Syntypes examined. TOGO: 1 ♂, 2 ex., Togo; Collection E. Candèze; Tilotarsus morosus Cand., det. E. Candèze [IRSNB curatorial label]. The male also bears Candèze's blue bordered label; n. sp. 94 morosus Cand., Togo and a label with the word 'Type' in an unknown hand (IRSNB, Brussels).

Agrypnus multipunctatus (Elston) **comb. n.**

Lacon multipunctatus Elston, 1927 : 358.
Lacon multipunctatus Elston; Neboiss, 1956 : 10.

The description is based on an unrecorded number of specimens from AUSTRALIA: Northern Territory, Port Darwin (*W. K. Hunt*).

Syntype-material (see Hayek, 1973 : 274), SAM, Adelaide, AM, Sydney.

Syntype examined. AUSTRALIA: 1 ♀, N. Territory; Lacon multipunctatus Elston, Co-Type [Elston]; A. H. Elston Collection (AM, Sydney).

Agrypnus murinus (Linnaeus) [p. 186]

Elater rufipes DeGeer, 1774 : 150 pars. [Synonymized by Goeze, 1777 : 557.]
Elater nebulosus Razoumowsky, 1789 : 161. [Synonymized by Schoenherr, 1817 : 279.]
Lacon kokeilii Kuester, 1845 : No. 6. [Synonymized by Candèze, 1857 : 113.] [Synonymy confirmed.]

Elater rufipes DeGeer. No syntypes have been found but it is clear from the description that DeGeer had before him a mixed series of *Prosternon tessellatum* (Linnaeus) and *Agrypnus murinus* (Linnaeus). See also p. 187.

Elater nebulosus Razoumowsky. Razoumowsky seems to have based his description on material in the various collections to which he had access (Razoumowsky, loc. cit. xi) but apart from M. Desruines he does not record to whom these collections belonged.

Type-material. Assumed to be lost.

The description, which compared the colour of the beetle to that of certain birds of prey or old birch bark, suggests that Schoenherr's synonymy is justified.

Elater kokeilii Kuester. Kuester's collection was broken up and the fate of the Elateridae is unknown (Horn & Kahle, 1935 : 114). From the description there is little doubt that Kuester had before him a large female *Agrypnus murinus* (Linnaeus).

Agrypnus muscerda (Candèze) [p. 187]

Additional syntypes examined: SOUTH AFRICA: 1 ex., muscerda Cdz. Cap. [Cand., blue border]; Collection E. Candèze; Lacon muscerda Cand., det. E. Candèze [IRSNB curatorial label]. 1 ex., Cap; with IRSNB curatorial label and Candèze collection label (IRSNB, Brussels). It seems reasonable to regard the 3 specimens in the BMNH (Hayek, 1973 : 187) as part of the syntype series. 1 ex., Cap. B. Sp.; D. Candèze (MCSN, Genoa).

Agrypnus muscosus (Candèze) [p. 187]

Additional syntypes examined. INDIA: 2 ex., Kanara; Collection E. Candèze; Lacon muscosus Cand., det. E. Candèze [IRSNB curatorial label]. One specimen bears Candèze's yellow-bordered label: n. sp. 1893 muscosus Cand. Bombay Andr. 1 ex., Belgaum S, other labels as above but without Candèze's determination label (IRSNB, Brussels).

Agrypnus nigrescens (MacLeay) **comb. n.**

Lacon nigrescens MacLeay, 1888 : 1234.
Lacon nigrescens MacLeay; Neboiss, 1961 : 8.

LECTOTYPE (present designation). AUSTRALIA: ♀, N.W. Aust.; Lacon nigrescens MacL. Barrior [sic] Range N.W. Aust. [MacLeay] (ANIC, Canberra).

For a note on the locality see *Agrypnus atricolor* (MacLeay) p. 209.

Agrypnus opacus (Candèze) **comb. n.**

Tilotarsus [sic] *opacus* Candèze, 1900 : 78.
Lobotarsus opacus (Candèze); Schwarz, 1906 : 30.

LECTOTYPE (present designation). 1 ♂, Guinée; n. sp. 98 opacus Cdz. Guinée [Cand., blue border]; Collection E. Candèze; Tilotarsus opacus Cand., det. E. Candèze [IRSNB curatorial label]; Type (IRSNB, Brussels). The specimen is 9 mm long and 3 mm wide compared with the published measurements of 7·5 and 2 mm.

At the time at which Candèze was working the term Guinée was often used for the west coast of Africa from Cape Negro, 15°45′ S to Cape Verga 10°18′ N. I have not seen any specimens with a more precise locality.

Agrypnus ornatellus (Candèze) [p. 193]

Syntype examined. MADAGASCAR: 1 ex., Madagascar; n. sp. ornatellus Cdz. Madag. [Cand., blue border]; Collection E. Candèze; Lacon ornatellus Cand. det. E. Candèze [IRSNB curatorial label]; Type (IRSNB, Brussels).

Agrypnus ornatus (Candèze) [p. 193]

Syntypes examined. JAVA: 1 ♀, ornatus Cdz. Java. C.Mn. [Cand., yellow border]; Collection E. Candèze; Lacon ornatus Cand., det. E. Candèze [IRSNB curatorial label]. 1 ♂, Cand. type [unknown handwriting]; Candèze collection and IRSNB curatorial determination label. 8 ex., Java, Candèze collection and IRSNB curatorial labels (IRSNB, Brussels).

Agrypnus orthoderus (Elston) **comb. n.**

Lacon orthoderus Elston, 1924 : 204.
Lacon orthoderus Elston; Neboiss, 1956 : 11.

The description is based on an unrecorded number of specimens from Australia: Northern Territory (Blackburn collection).

Syntype-material (see Hayek, 1973 : 274). SAM, Adelaide, AM, Sydney.

The generic attribution is based on Elston's comment that the species is near *productus* Elston (=*Agrypnus*, see p. 233).

Agrypnus paenulatus (Boheman) [p. 193]

Additional paralectotype. South Africa: 1 ex., Caffraria; J. Wahlb.; paenulatus Boh. Caffr. [Cand., blue border]; Collection E. Candèze; Lacon paenulatus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus palliatus (Candèze) [p. 194]

Syntype examined. Madagascar: 1 ex., Madagascar; palliatus Cand. Madag. Andrangoloaca [Cand., blue border]; Collection E. Candèze; Lacon palliatus Cd. det. E. Candèze [IRSNB, curatorial label] (IRSNB, Brussels).

Agrypnus palpalis (Candèze) [p. 195]

Lectotype (designated by Van Zwaluwenburg, 1959 : 354). Australia: sex undetermined, Coll. Monchict; Collection E. Candèze; Lacon palpalis Cd. det. E. Candèze [IRSNB curatorial label]; Lectotype Van Z. 1957 [Van Zwaluwenburg] (IRSNB, Brussels).

Paralectotype. 1 ♂, Australie septentrionale; n. sp. palpalis Austr. Sept. [? Cand.]; Collection E. Candèze; Lacon palpalis Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

A third specimen (presumably one of Van Zwaluwenburg's 'two additional specimens') standing under the name in the IRSNB, Brussels bears the locality Cape York and in my opinion cannot be regarded as part of the original syntype-series.

Agrypnus parallelus (Candèze) [p. 196]

LECTOTYPE (present designation). Australia: ♂, N. Holl. C. Cdze; Janson coll. ex. Candèze, 1903 : 130; Lacon parallelus Cdz. n. sp. N. Austr. Th. [Cand.]; Lacon parallelus Cand. type [Gahan] (BMNH). Length 10·5 mm.

There are 3 specimens (1 ♂, 2 ♀) from Port Denison [Queensland] in the IRSNB. One female bears Candèze's red-bordered determination label. These specimens measure between 11 and 13 mm in length compared with the published length of 10·5 mm. It seems probable that Candèze acquired these specimens some time after making the description.

The MCSN, Genoa also possesses one specimen from the same locality.

Agrypnus pardalinus (Candèze) **comb. n.**

Lacon pardalinus Candèze, 1882 : 9.
Adelocera pardalinus (Candèze); Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). India: ♀, Himalaya; n. sp. pardalinus Cdz. Himalaya [Cand.]; Collection E. Candèze; Lacon pardalinus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

The description is based on an unrecorded number of specimens from Darjeeling. As Darjeeling is in the Himalaya region and as the specimen agrees well with the description I consider it not unreasonable to accept it as a syntype.

Agrypnus parvulus (MacLeay) **comb. n.**

Lacon parvulus MacLeay, 1888 : 1239.
Lacon parvulus MacLeay; Neboiss, 1956 : 11.

LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Austr.; Lacon parvulus MacL. King's Sound, N.W. Austr. [MacLeay] (ANIC, Canberra).

Paralectotype. 1 ♀, N.W. Austr. (ANIC, Canberra).

Agrypnus pauliani (Fleutiaux) **comb. n.**

Lobotarsus pauliani Fleutiaux, 1941*d* : 38.

Holotype. CAMEROUN: ♀, Mt Cameroun, 900–100 m versant sud-est; Museum Paris P. Lepesme. R. Paulian A. Villiers Cameroun, 1939; Lobotarsus pauliani type [Fleut.] (MNHN, Paris).

The metathorax is very short and the specimen appears to be wingless. The scutellum is strongly transverse and resembles that of the figure of *Archontoides pretoriensis* Cobos, 1966 (=*Agrypnus paenulatus* (Boheman, 1851)).

Agrypnus pauliani (Girard) [p. 197]

See *Agrypnus girardi* **nom. n.** p. 219.

Agrypnus pauper (Candèze) [p. 197]

Syntypes examined. JAVA: 2 ex., Giava, Teibodas Ott. 1874 O. Beccari. One specimen bears in addition two labels: 'type' and 'pauper Cand.' [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Agrypnus pecirkai (Jagemann) **stat. n., comb. n.**

Lacon schwarzi var. *pecirkai* Jagemann, 1944 : 333.

LECTOTYPE (present designation). CHINA. ♂, Thibet, Le Moult; Lacon schwarzi a. pecirkai Jg. Typus. Det. Jagemann [Jagemann]; Type (NM, Prague).

This species differs from *A. schwarzi* Jagemann in that the mesosternal groove is oblique and not distinctly angled.

Agrypnus perplexus (Elston) [p. 197]

Additional syntype examined. AUSTRALIA: ♀, Fortescue R. Hammersley Range, NWA. W. D. Dodd; perpexus Elston, Co-type (NR, Stockholm).

Agrypnus pictilis (Schwarz) [p. 197]

LECTOTYPE (present designation). TANZANIA: ♂, D. Ost Afr. v. Bennigs.; coll. Schwarz; pictilis n. sp. Schw. [Schwarz]; (DEI, Eberswalde).

Paralectotypes. 1 ♂, labels as lectotype but without Schwarz's determination label. 3 ♂, Ost Africa, Coll. v. Bennigsen; Typus. One specimen bears in addition a label in an unknown hand: Lacon pictilis Schwarz n. sp. Ost Africa (DEI, Eberswalde).

Schwarz comments that *pictilis* is related to *foedus* Candèze. The two species do bear a certain resemblance to one another but *pictilis* has simple tarsi whereas those of *foedus* are distinctly lobed.

Agrypnus pictus (Candèze) comb. n.

Lacon pictus Candèze, 1878*b* : LIII (6).
Adelocera picta (Candèze); Fleutiaux, 1926 : 96.

Syntype examined. MADAGASCAR: 1 ♀, Madagascar; n. sp. pictus Cdz. Mad. [Cand.]; Lacon pictus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

Agrypnus piger (Candèze) [p. 198]

Syntypes examined. INDIA: 1 ♀, Bengale; n. sp. piger Cdz. Bengale [Cand.]; Lacon piger Cd., det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. 14 ex., same locality and collection labels but without determination labels (IRSNB, Brussels). 1 ♀, Tetara; L. piger nov. spec. fascicule iv. p. 7 [Cand.] (MNHN, Paris).

The published locality is Tetara, Bengale. Experience has shown that very often only one specimen of a series was labelled with the full locality and the rest only with an indication of the general region.

Agrypnus pinguis (Candèze) [p. 198]

Syntype examined. AUSTRALIA: 1 ex., Cooktown; n. sp. pinguis Cdz. Cooktown St.; [Cand., red border]; Lacon pinguis Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze; Type (IRSNB, Brussels).

Agrypnus pipitzi (Candèze) [p. 199]

Syntypes examined. 1 ex., MADAGASCAR: Madagascar; pipitzi Cdz. Madag. Pip. [Cand., blue border]; Lacon pipitzi Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. 3 ex., same locality and collection labels but without Candèze's determination label (IRSNB, Brussels).

Agrypnus pistorius (Candèze) [p. 199]

Additional syntypes examined. INDIA: 12 ex., Kanara; Mars 1893 pistorius Cand. Kanara A. [Cand., yellow border]; Lacon pistorius Cd. det. E. Candèze [IRSNB curatorial label]; Col lection E. Candèze. 1 ex., same locality and collection labels, but without Candèze's determination label (IRSNB, Brussels).

Agrypnus plagiatus (Candèze) [p. 199]

Syntypes examined. AUSTRALIA: 1 ex., Collect. Monchicourt; n. sp. plagiatus Cdz. Pt. Denis. [Cand., red border]; Lacon plagiatus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. 1 ex., Port Denison, Lacon plagiatus Cd. det., E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels). A third specimen bears two locality labels, Port Denison and Cooktown. As it measures 12·5 mm compared to the published length of 9 mm it has been excluded from the syntype-series.

Agrypnus planatus (Candèze) [p. 199]

Syntype examined. MADAGASCAR: 1 ex., Tananarivo; n. sp. iii 1893 planatus Cand. Tananarivo [Cand., blue border]; Lacon planatus det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

The published locality is Imerina. Tananarivo lies at the centre of the district of Imerina which was once an independent state. The description was not published until 1895.

Agrypnus pleureticus (Candèze) [p. 200]

Additional syntypes examined. AUSTRALIA: 3 ex., Australie; Lacon pleureticus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. One specimen bears Candèze's red-bordered label: pleureticus Cdz. Austr. (IRSNB, Brussels).

The published localities are Queensland, Rockhampton and Brisbane but up till now no specimens bearing these localities have been discovered.

Agrypnus principatus (Schwarz) **comb. n.**

Lacon principatus Schwarz, 1905*a* : 259.
Adelocera principatus (Schwarz); Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). SRI LANKA: ♀, Kandy; Coll. Schwarz; Typus; principatus Schw. [Schwarz] (DEI, Eberswalde).

The description is based on an unrecorded number of specimens.

Agrypnus procellosus (Candèze) [p. 201]

Syntypes examined. MADAGASCAR: 1 ex., n. sp. iii 1893 procellosus Cand., Tananarivo S. [Cand., blue border]; Lacon procellosus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. 2 ex., Tananarivo, remaining labels as previous specimen but without Candèze's determination label.

The 'S' on Candèze's determination label probably stands for Sikora, the collector. The published locality is Imerina, see note on this locality under *A. planatus* (Candèze) p. 232.

Agrypnus productus (Elston) **comb. n.**

Lacon productus Elston, 1924 : 203.
Lacon productus Elston; Neboiss, 1956 : 12.

The description is based on an unrecorded number of specimens from AUSTRALIA: Northern Territory, Darwin (*W. K. Hunt*).

Syntype-material (see Hayek, 1973 : 274). SAM, Adelaide, AM, Sydney.

The generic attribution is based on the description and Elston's comment that the species bears some resemblance to *caliginosus* Guérin-Méneville (=*Agrypnus*, see Hayek, 1973 : 134).

Agrypnus pujoli (Girard) **comb. n.**

Lobotarsus pujoli Girard, 1969 : 223, fig. 5.

Holotype. CENTRAL AFRICAN REPUBLIC: ♂, La Maboké, prés Bangui 10.1.1967 (R. Pujol) (MNHN, Paris). Not examined.

Paratype. 1 ♀, same data (MNHN, Paris). Not examined.

The generic attribution is based on the description and figures.

Agrypnus pulvereus Candèze [p. 202]

Lobotarsus ambiguus Schwarz, 1905*b* : 279. **Syn. n.**

Lobotarsus ambiguus Schwarz. Syntypes examined. MADAGASCAR: 1 ♀, Madagascar; Coll. Schwarz; Cotypus; Ambiguus Schw. [Schwarz]; pulvereus Cand. [Fleut.]. 2 ♀, 1 ex. (without abdomen), same locality & collection labels (DEI, Eberswalde). As far as I am aware Fleutiaux did not publish the synonymy.

Agrypnus pupillus (Candèze) [p. 203]

Lectotype (designated by Van Zwaluwenburg, 1959 : 354). PAPUA NEW GUINEA: ♀, N. Guinea, Dilo Loria vi–vii 90; Typus; pupillus Cand. [replacement label in unknown handwriting; see *Adelocera acerbus* (Candèze) p. 189]. Lectotype, Van Zwaluwenburg (MCSN, Genoa).

Paralectotypes: 4 ex., same locality as lectotype (MCSN, Genoa); 5 ex., same locality as lectotype (IRSNB, Brussels). 1 ♂, 1 ex., N. Guinea, Ighibirei [sic] Loria vii–viii 90 (MCSN, Genoa); 4 ex., same locality. One bears Candèze's determination label: n. sp. 1892 pupillus Cand. N. Guinea (IRSNB, Brussels).

Candèze records the localities as Dilo, Hula, Iguibirei, etc. According to Salvadori (1891 : 798) Dilo and Igibirei [sic] are on the River Kemp Weltch [Wanigela R. 10°03′ S, 147°43′ E]. The location of Hula is not mentioned by Salvadori.

Agrypnus rectangulus (Schwarz) **comb. n.**

Lacon rectangulus Schwarz, 1903*b* : 378.
Adelocera rectangulus (Schwarz) Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). PAPUA NEW GUINEA: ♀, D. N. G.; Coll. Schwarz; rectangulus Schw. [Schwarz] (DEI, Eberswalde).

The description is based on an unrecorded number of specimens from 'Deutsch Neu Guinea', a former German possession in N.E. New Guinea.

Agrypnus recticollis (Elston) [p. 204]

LECTOTYPE (present designation). AUSTRALIA: sex not determined, Malanda; Queensl. Mjoberg; recticollis Elston Type (NR, Stockholm).

Paralectotypes. 2 ex., Malanda; Queensl. Mjoberg; recticollis Elston Co-type (NR, Stockholm).

Agrypnus reductus (Candèze) [p. 205]

Syntypes examined. SUMATRA: 2 ex., Sumatra, Lacon reductus Cd. det. E. Candèze [IRSNB, curatorial label]; Collection E. Candèze (IRSNB, Brussels). One specimen bears Candèze's yellow-bordered determination label: n. sp. reductus Cdz. sumatra Dn.

Agrypnus recticulatus (Elston) [p. 205]

LECTOTYPE (present designation). AUSTRALIA: ♂, Kimberley district; N.V. Austr.; Jan; reticulatus Elston Type (NR, Stockholm).

Paralectotypes. 1 ex., Kimberley district; N.V. Austr. Mjoberg; Nov. Elston, Co-type. 1 ♂, Noonkanbah; dec.; reticulatus Elston Co-type (NR, Stockholm).

Agrypnus robustus (Schwarz) **comb. n.**

Lacon robustus Schwarz, 1903*b* : 377.
Adelocera robusta (Schwarz) Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). PAPUA NEW GUINEA: ♀, Simbang [6°33′ S, 147°48′ E] D. N. G.; Coll. Schwarz; Typus; robustus Schw. [Schwarz] (DEI, Eberswalde). The specimen measures 16·5 mm in length compared with the published length of 18 mm.

A second female, also labelled 'Typus' but without a locality label, stands beside the lectotype in the collection. As it is only 15·6 mm long and does not agree well with the description in such particulars as the puncturation of the pronotum I do not consider it to be part of Schwarz's original series.

Agrypnus rubescens (MacLeay) **comb. n.**

Lacon rubescens MacLeay, 1888 : 1234.
Lacon rubescens MacLeay; Neboiss, 1961 : 9.

LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Aust. (ANIC, Canberra). Length 10·5 mm.

Paralectotype. ♂, N.W. Aust. Lacon rubescens MacL. Barrior [sic] Range N.W. Aust. [MacLeay]; det. (ANIC, Canberra). Length 11 mm.

The specimen without MacLeay's determination label has been selected as the lectotype as it agrees more closely with the published length of 5 lines (=10·6 mm). Certain details in the description show that there can be no doubt that MacLeay had both specimens in front of him when he wrote it.

For a note on the locality see *Agrypnus atricolor* (MacLeay) p. 209.

Agrypnus rubicundulus (MacLeay) **comb. n.**

Lacon rubicundulus MacLeay, 1888 : 1237.
Lacon rubicundulus (MacLeay); Neboiss, 1961 : 9.

LECTOTYPE (present designation). AUSTRALIA: ♀, N.W. Austr.; Lacon rubicundulus MacL. King's Sound, N.W. Aust. [MacLeay] (ANIC, Canberra).

Agrypnus rufopiceus (MacLeay) **comb. n.**

Lacon rufopiceus MacLeay, 1888 : 1235.
Lacon rufopiceus MacLeay; Neboiss, 1961 : 9.

LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Aust.; Lacon rufopiceus MacL. Syntype det. A. Neboiss 1968 [Neboiss] (ANIC, Canberra). Length 10 mm.

Paralectotypes. 2 ♀, with the same labels as the lectotype. One (length 12 mm) bears MacLeay's determination label: Lacon rufopiceus, Barrior Range [sic] N.W. Aust. [MacLeay]. The other measures 11 mm.

The male without MacLeay's determination label has been selected as the lectotype as it agrees more closely with the published length of 4 lines (=10 mm).

For a note on the locality see *Agrypnus atricolor* (MacLeay) p. 209.

Agrypnus rufulus (Elston) **comb. n.**

Lacon rufulus Elston, 1927 : 361.
Lacon rufulus Elston; Neboiss, 1956 : 12.

The description is based on an unrecorded number of specimens from AUSTRALIA: N.W. Australia, Fortescue River, Hammersley Range (*W. D. Dodd*).

Syntype material. SAM, Adelaide, AM, Sydney.

The generic attribution is based on the description and Elston's comments that the species resembles *laticollis* Candèze (=*Agrypnus*, see Hayek, 1973 : 174).

Agrypnus rusticus (Candèze) [p. 206]

Syntype examined. MADAGASCAR: 1 ♀, Madagascar; n. sp. 1892 rusticus Cand. Madag. Branc. [Cand., blue border]; Lacon rusticus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. 2 ex., same labels but without Candèze's determination label (IRSNB, Brussels).

The published locality is Nossi Be. No specimens with this locality have been found. 'Branc.' on Candèze's determination label is believed to stand for Brancsik of Trencsin from whom Candèze received the material.

Agrypnus sauteri (Ohira) **comb. n.**

Adelocera (*Sabikikorius*) *sauteri* Ohira, 1970*b* : 208.

Holotype. TAIWAN: ♂, Kanshirei, 1908, H. Sauter (TM, Budapest). Not examined.

Paratype. TAIWAN: 1 ♂, Kosempo 908 vi; Formosa, Sauter; Adelocera sauteri det. Ohira 1971 [Ohira] (Ohira coll.).

The published locality of the paratype is the same as that of the type. Whether this is an oversight on the part of the author, or whether the wrong label has been attached to the specimen is unknown.

Agrypnus schwarzi (Jagemann) **comb. n.**

Lacon schwarzi Jagemann, 1944 : 333.

LECTOTYPE (present designation). CHINA: ♀, Thibet, Coll. Le Moult; Lacon schwarzi nov. sp. mihi prope macroderus Candèze [Jagemann]; Typus (NM, Prague).

Paralectotype. ♀, with the same labels as the lectotype (NM, Prague).

The mesosternal groove is distinctly angled, a characteristic also found in *A. costicollis* (Candèze) and *A. fulvastra* (Fleutiaux).

This species does not bear a particularly close resemblance to *A. macroderus* (Candèze) (cf. Jagemann, loc. cit.).

Lacon schwarzi var. *pecirkai* Jagemann (see p. 231), in which the mesosternal groove is oblique as in the majority of species, is not conspecific with *A. schwarzi* (Jagemann).

Agrypnus sculptus (Candèze) [p. 209]

Syntypes examined. AUSTRALIA (New South Wales): 4 ex., Raroo [sic] River; Lacon sculptus det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. One specimen, which has lost its abdomen, bears in addition two labels: Riv. Paroo; sculptus Cdz. Paroo riv. [Cand., red border]. 1 ex., Riv. Darling; Lacon sculptus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels). It seems reasonable to include the 7 specimens in the BMNH recorded previously in the syntype series. 1 ex., Darling R. D. Candèze (MCSN, Genoa).

Agrypnus scutellaris (Candèze) [p. 209]

Agrypnus scutellaris hamai Ohira, 1967 : 99.

Lacon scutellaris Candèze. Syntype examined. JAPAN (Ryukyu Retto Archipelago): 1 ♀, Oshima, Liu-kiu, n. sp. iv. 1891 scutellaris Cand. Japan Schönf. [Cand., yellow border]. Lacon scutellaris Cd. det. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

The BMNH collection contains a number of male and female *fuliginosus* (Candèze) from the Lewis collection from Yokohama. I suspect that these may be the specimens which Lewis (1896 : 336) believed to be *scutellaris* Candèze.

Female *scutellaris* differ from *fuliginosus* in that they possess a raised shiny area on the last abdominal sternite and short polished transverse lines on either side of the mid line on the posterior third of the pronotum. No male *scutellaris* are known to me, but Ohira (1967*b* : fig. 5) gives a figure of his interpretation of *scutellaris*.

Agrypnus scutellaris hamai Ohira. Holotype. JAPAN (Ryukyu Retto Archipelago): ♂, Iriomote (Hoshidate), 21–V.1963, Y. Hama (Ohira collection). Not examined.

Paratype. ♀, Iriomote (Riv-Urauchi), 31–VII 1964, M. Yasui (located in one of the collections recorded by Ohira, 1969 : 95). Not examined.

Agrypnus scutellatus (Candèze) [p. 209]

Additional syntypes examined. JAVA: 1 ? ♂, Java; scutellatus Cdz. Malacc. [Cand., yellow border]; Cand. type; Lacon scutellatus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. 1 ♂, 1 ♀, Malacca; Lacon scutellatus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

It would appear that Candèze's determination label has been affixed to the wrong specimen.

Agrypnus sericans (Candèze) **comb. n.**

Lacon sericans Candèze, 1857 : 112.
Adelocera sericans (Candèze) Fleutiaux, 1926 : 96.

The description is based on an unrecorded number of specimens from 'des Indes Orientales' [see Hayek, 1973 : 271] in the Dohrn collection. Candèze (1891 : 23) records the locality as Ceylon.

Type-material. ? IZPAN, Warsaw.

The generic attribution is based on the following specimen: 1 ex., Ceylon; sericans Cand. Ceylan Fl. [Cand., yellow border]; Lacon sericans Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. This may be the specimen from which Candèze obtained the locality for his 1891 catalogue.

Agrypnus serricollis (Candèze) [p. 210]

Additional paralectotype examined. JAVA. 1 ex., serricollis Cdz. Java [Cand., yellow border]; Lacon serricollis Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze; Cand. type (IRSNB, Brussels).

Agrypnus setosulus (Schwarz) **comb. n.**

Lacon setosulus Schwarz, 1903*b* : 377.
Adelocera setosula (Schwarz) Fleutiaux, 1926 : 96.

The description is based on an unrecorded number of specimens from PAPUA NEW GUINEA: 'Deutsch Neu-Guinea'.

Type-material. ? DEI, Eberswalde.

The generic attribution is based on the description and Schwarz's comment that the species resembles *limosus* [Candèze] (=*Agrypnus*, see Hayek, 1973 : 177).

Agrypnus setulosus (Candèze) [p. 211]

Lectotype (van Zwaluwenburg, 1959 : 352). LESSER SUNDA ISLANDS: Sumbawa Colffs.; n. sp. setulosus Cdz. Sumbawa Lsb. [Cand., yellow border]; Lacon setulosus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze; Lectotype van Zwaluwenburg 1957 (IRSNB, Brussels).

Paralectotypes. 1 ex., same locality and collection labels but without Candèze's determination label (IRSNB, Brussels). 4 ex., recorded by Hayek (1973 : 211) (MNHN, Paris). The collector was Colffs not Coiffs. No specimens from Flores have been located.

Agrypnus shirakii (Matsumura) **comb. n.**

Lacon shirakii Matsumura, 1910 : 39, pl. 27, fig. 24.
Adelocera shirakii (Matsumura) Fleutiaux, 1926 : 96.
Colaulon (*Cryptolacon*) *shirakii* (Matsumura) Ohira, 1972 : 25.

The description is based on a single female specimen collected on sugar cane by Mr T. Shiraki in Taihok, Formosa.

Holotype. Taiwan Agricultural Research Institute, Taiwan or Hokkaido University, Japan (pers. comm. from Dr H. Ohira).

The generic attribution is based on a female from Formosa, Chippon determined by Dr H. Ohira and kindly presented by him to the BMNH.

The date of publication of this species is generally given as 1911, but the description and a figure appeared in Matsumura's 1910 work which seems to have been overlooked probably because in his preliminary list of sugar cane insects (1910*a* : 139) Masumura announces that the description of the new species will appear 'gleichzeitig' in the 'Annales' of the Societé Entomologique de Belge. The descriptions, but not the figures, were published in 1911, *Mém. Soc. r. ent. Belge* 18 : 129–150. Matsumura (1911 : 146) records the specimen as a male. It is not possible to confirm the sex from the figure.

Agrypnus simplex (Candèze) [p. 212]

Additional syntypes examined. GABON: 3 ex., Gabon; Lacon simplex Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. One specimen bears two additional labels: simplex Cdz. Gabon [Cand., blue border]; Collection Fairmaire (IRSNB, Brussels).

Agrypnus sinensis (Candèze) [p. 212]

Lacon sinensis Candèze, 1857 : 139.
Compsolacon tonkinensis Jagemann, 1944 : 334. **Syn. n.**

Compsolacon tonkinensis Jagemann. LECTOTYPE (present designation). VIETNAM: ♂, Laos, Tonkin: Compsolacon tonkinensis Jg. Jagemann det. Typus [Jagemann]; Collection Dr. E. Jagemann, Moravskè Museum, Brno; Transcriptio. Compsolacon tonkinensis sp. n. E. Jagemann det; Syntypus (MM, Brno).

Paralectotypes. 1 ♀, Laos, Tonkin; Compsolacon tonkinensis Jg. Jagemann det. Typus [Jagemann] (NM, Prague).

Agrypnus spinifer (Candèze) [p. 214]

Syntype examined. MADAGASCAR: 1 ex., Madagascar; mss [?] spinifer Cdz. Madagascar [Cand]; Type; Lacon spinifer Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

As the specimen agrees well with the description it seems more probable that it is the one on which Candèze bases his description rather than the one labelled 'spinipes' in the MNHN, Paris. Candèze did not publish a description of 'spinipes'.

Agrypnus spissicollis (Candèze) [p. 214]

Syntypes examined. MADAGASCAR: 2 ex., Tananarivo; Lacon spissicollis Cd. det. E. Candèze [IRSNB curatorial label] Collection E. Candèze. One specimen bears in addition: n. sp. spissicollis Cand. Tananarivo, Sik. [Cand., blue border]; Type (IRSNB, Brussels).

The published locality is Antananarivo. Tananarivo is an alternative spelling.

Agrypnus spretus (Candèze) **comb. n.**

Lacon spretus Candèze, 1882 : 8.
Adelocera spretus (Candèze) Fleutiaux, 1926 : 96.

Syntype examined. BORNEO: 1 ex., Schwaner, Borneo; n. sp. spretus Cdz. Borneo [Cand., yellow border]; Type; Lacon spretus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

Agrypnus spurcus (Candèze) **comb. n.**

Lacon spurcus Candèze, 1865 : 11.
Adelocera spurcus (Candèze) Fleutiaux, 1926 : 96.

LECTOTYPE (present designation). PHILIPPINES: ♀, Cuming, Ins. Phi. (RNH, Leiden). The description is based on an unrecorded number of specimens from 'Luçon'. The specimen stands beside Snellen van Vollenhoven's det. label (Krikken, pers. comm.). Snellen van Vollenhoven is known to have removed the original determination labels and replaced them by his own.

Agrypnus squalescens (Fairmaire) [p. 214]

Syntypes examined. MADAGASCAR: 1 ♀, Madag.; Tilotars. squalescens Fairm. Madag. [? Fairm.]; Collection Fairmaire; squalescens Frm. Madag. Frm. [Cand., blue border]; Type; Lacon squalescens Frm. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels). 1 ex., Madag.; Museum Paris Madagascar Collection Leon Fairmaire 1906; Tilotarsus squalescens Frm. Cand. det. [unknown handwriting]; Type squalescens Fairm. Mus Bruxelles [Fleut.] (MNHN, Paris).

Agrypnus sticticus (Candèze) [p. 215]

Lacon sticticus Candèze, 1895*b* : 56.
Adelocera sticticus (Candèze) Fleutiaux, 1926 : 96.
Agrypnus stictus (Candèze); Hayek, 1973 : 215. [Incorrect subsequent spelling.]

Candèze does not record a locality for this species. The paper deals mainly with material collected by Alluaud around Diego Suarez and Mont d'Ambre, but as other localities and collectors are recorded I feel justified in regarding the following specimen as a syntype.

Syntype. MADAGASCAR: 1 ex., Madagascar; n. sp. sticticus Cand. Madag. [Cand., blue border]; Collection E. Candèze (IRSNB, Brussels).

Agrypnus stricticollis (Fairmaire) [p. 216]

A synonym of *Agrypnus glirinus* (Candèze). See p. 219.

Agrypnus subcompactus (Elston) **comb. n.**

Lacon subcompactus Elston, 1927 : 356.
Lacon subcompactus Elston; Neboiss, 1956 : 13.

The description is based on an unrecorded number of specimens from AUSTRALIA: New South Wales, Glenn Innes (*C. Deane*).

Syntype-material (see Hayek, 1973 : 274). AM, Sydney.

The generic attribution is based on the description and Elston's comment that the species resembles *compactus* Candèze (=*Agrypnus*, see p. 215).

Agrypnus submarmoratus (Elston) [p. 217]

Additional syntypes examined. 2 ♀, Cairns dist. AM, Lea; submarmoratus Elston Co-type; Paratypus (NR, Stockholm). The specimens were presumably acquired by presentation or exchange.

Agrypnus subocellatus (Candèze) [p. 217]

Syntypes examined. MADAGASCAR: 1 ex., Nossi Bé reçu du Boyer; n. sp. subocellatus Cdz. Nossi Bé [Cand., blue border]; Lacon subocellatus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze; Type (IRSNB, Brussels). 1 ♂, Nossi Bé, reçu du Boyer; Lacon subocellatus Cdz. type [Cand.] (MNHN, Paris).

Agrypnus suboculatus (Candèze) [p. 218]

Syntypes examined. MADAGASCAR: 1 ♀, 2 ex., Madagascar; Lacon suboculatus Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. One specimen bears Candèze's blue-bordered label: n. sp. suboculatus Cdz. Mad. (IRSNB, Brussels).

The published locality is Antananarivo. No specimens with this locality have been found.

Agrypnus subreductus (Girard) **comb. n.**

Lobotarsus subreductus Girard, 1971 : 565, figs 13, 15.

Holotype ♂, paratypes 1 ♂, 1 ♀. IVORY COAST: Lamto, entre le 10 et le 29.2.1968. The holotype was bred, the paratypes caught at night. (Holotype, MNHN, Paris. Paratypes, location unknown.) Not examined. The generic attribution is based on the description and Girard's comment that the species resembles *reductus* Candèze (=*Agrypnus gabonensis* Hayek, see Hayek, 1973 : 158).

Agrypnus subsericeus (Candèze) [p. 218]

Holotype. WEFT IRIAN: ♂, New Guinea, Hatam VII, Beccari, 1875; Typus; subsericeus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Hatam is at an altitude of 1520 m in the Arfak Mountains. See Beccari (1924).

Agrypnus subtilis (MacLeay) **comb. n.**

Lacon subtilis MacLeay, 1888 : 1236.
Lacon foveicollis MacLeay, 1888 : 1237. **Syn. n.**
Lacon subtilis MacLeay; Neboiss, 1961 : 9.

Lacon subtilis MacLeay. LECTOTYPE (present designation). AUSTRALIA: ♂, N.W. Aust.; Lacon subtilis MacL. King's Sound, N.W. Aust. [MacLeay] (ANIC, Canberra).

Lacon foveicollis MacLeay. LECTOTYPE (present designation). AUSTRALIA: ♀, N.W. Aust.; Lacon foveicollis MacL. King's Sound, N.W. Aust. [MacLeay] (ANIC, Canberra).

The only difference between the two specimens is the presence of a distinct pair of depressions at the base of the prothorax of *foveicollis*. Faint traces of these depressions are present in *subtilis*.

Agrypnus subtuberculatus Schwarz [p. 218]

Syntype examined. CAMEROUN: ♂, Kameroun, Conradt; Coll. Schwarz; Tylotarsus subtuberculatus Schw. [Fleut.]; Paralectotype; Lobotarsus subtuberculatus Schw. C. Girard vid. [Girard] (MNHN, Paris).

As far as I am aware a lectotype designation has not been published. The remaining material is almost certainly in the DEI, Eberswalde.

Agrypnus tabularius (Candèze) **comb. n.**

Lacon tabularius Candèze, 1892*c* : 483.
Adelocera tabularia (Candèze) Fleutiaux, 1926 : 96.

Syntypes examined. INDIA: 1 ♀, Bengale; n. sp. 1892 tabularius Cand. Bengale, Barwai P. C. [Cand., yellow border]; Lacon tabularius Cd., det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze. 1 ♀, 1 ex. without abdomen, labels as above but without Candèze's determination label. 1 ♂ with similar labels is not here included in the syntype-series as it measures only 14 mm in length compared to the published length of 18–20 mm.

The published locality is Chota Nagpore (see Hayek, 1973 : 273).

Agrypnus taciturnus (Candèze) [p. 219]

LECTOTYPE (present designation). LAOS: ♂, Laos; Collection E. Candèze; Lacon taciturnus Cd., det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

The lectotype is not conspecific with the two syntypes in the BMNH recorded by Hayek (1973). It is selected as the lectotype despite the fact that it lacks a determination label in Candèze's handwriting as it agrees slightly better with the description as regards the length (11·8 mm) and the proportions of the prothorax. The two syntypes are conspecific with *Agrypnus colonicus* (Candèze) q.v. p. 214.

Agrypnus tellini (Fleutiaux) [p. 220]

Lacon denticollis Fleutiaux, 1918*b* : 237. **Syn. n.**
Agrypnus denticollis (Fleutiaux) Hayek, 1973 : 148.

Agrypnus thomasi Hayek [p. 221]

Homeolacon gracilis Blackburn. Paralectotype examined. 1 ex., 2800 N.T. [on card mount, see Hayek, 1973 : 270]; Adelaide, G. Homeolacon gracilis Bl. Adelaide [Cand., red border]; Blackburn; Lacon gracilis Bl. det. Blackburn [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

The published locality is 'N. Territory of S. Australia'. The locality Adelaide probably refers to Adelaide River, Northern Territory and not Adelaide, S. Australia. No additional specimens of this species are known to me.

Agrypnus tonkinensis (Fleutiaux) [p. 221]

Additional paralectotypes examined. 2 ♀, Lac Tho, Hoa Binh, A de Cooman; Lacon tonkinensis Fleut. [Fleut.]; Don. E. Fleutiaux; Lacon tonkinensis Fleut. det. E. Fleutiaux [IRSNB curatorial label]. 1 ex., same locality with Fleutiaux's determination label; Collection E. Fleutiaux (IRSNB, Brussels).

Agrypnus triangularis (Schwarz) **comb. n.**

Lobotarsus triangularis Schwarz, 1903*a* : 362.

LECTOTYPE (present designation). CAMEROUN: ♂, Camerun; Sjostedt; Coll. Schwarz; Typus; triangularis Schw. [Schwarz] (DEI, Eberswalde).

Agrypnus triplehornorum (Knull) **comb. n.**

Colaulon triplehornorum Knull, 1973 : 39.

Holotype. U.S.A.: ♂, Texas, Monahans Sand Hills State Park, Ward. Co. 16.vii.1972 (*W. E., B. W. & C. A. Triplehorn*) (Ohio State University collection).

Allotype and paratypes. 1 ♀, 13 ex., from the type-locality, same date and collectors. 6 ex., same locality and collections, 8.vii.1968 (Ohio State University and author's collection).

The generic attribution is based on 1 ♂, 1 ♀ from the type-locality, 28.vii.1973 (*W. E. & C. A. Triplehorn*) determined by Professor Knull (BMNH). The wings of both specimens are reduced in length; they extend only a short distance beyond the posterior margin of the second abdominal sternite.

Agrypnus truquii (Candèze) [p. 223]

Additional paralectotype examined. 1 ex., Oaxaca; Mexico, Salle Collection truquii Cand. Oaxaca Ch. [Cand., green border]; Lacon truquii Cand. Salle coll. 1424; Lacon truquii Cd. det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels).

Agrypnus tuberculipennis (Miwa) **comb. n.**

Lacon tuberculipennis Miwa, 1929 : 230.

Holotype. TAIWAN: ♂ Baibara 15.vii.1926 (*Miwa*). Not examined.

Dr H. Ohira (pers. comm.) reports that he was unable to find the type in the Taiwan Agricultural Research Institute in which most of Miwa's types are preserved.

The generic attribution is based on the description and Miwa's comment that the species resembles *montanus* Miwa (=*Agrypnus*, see p. 228).

Agrypnus uncatus **nom. n.**

Lobotarsus hamatus Schwarz, 1903*a* : 360.
Agrypnus hamatus (Schwarz) **comb. n.** [Junior secondary homonym of *Agrypnus hamatus* (Candèze, 1893).]

Syntype examined. MADAGASCAR: 1 ♀, Madagascar; coll. Schwarz; Cotypus; hamatus Schw. [Schwarz]; spinifer Cand. [Fleut.] (DEI, Eberswalde).

The description is based on an unrecorded number of specimens from Madagascar.

To the best of my belief Fleutiaux did not publish the synonymy with *spinifer* Candèze. Only a comparison of the type-material will show whether his belief was justified.

Agrypnus uraiensis (Miwa) **comb. n.**

Lacon uraiensis Miwa, 1929 : 231.

Holotype. TAIWAN. ♀, Urai, 8–iv. 1926 (*M. Kato*). Not examined.

Dr Ohira (pers. comm.) tells me that he has not been able to examine the type which should be in the Taiwan Agricultural Research Institute where the majority of Miwa's types are preserved.

The generic attribution is based on the description.

Agrypnus validus (Elston) **comb. n.**

Lacon validus Elston, 1924 : 203.
Lacon validus Elston; Neboiss, 1956 : 13.

The description is based on an unrecorded number of specimens from AUSTRALIA: Queensland, Bowen (*A. Simpson*).

Syntype-material (see Hayek, 1973 : 274). SAM, Adelaide, AM, Sydney.

The generic attribution is based on the description and Elston's comparison with *crassus* Candèze (=*Agrypnus*, see p. 216).

Agrypnus variatus (Candèze) [p. 227]

LECTOTYPE (present designation). INDIA: ♂, Coll. R. I. Sc. N. B. Inde-Bengal coll. Candèze (ex coll. P. Cardon); cf. Bull. Mus. Inst. Nat. Belge 1890 p. CXLVIII; Lacon variatus Cd. det. E. Candèze [IRSNB curatorial labels] (IRSNB, Brussels).

Paralectotype. 1 ♂, same labels as the lectotype (IRSNB, Brussels).

The IRSNB, Brussels collection contains another male and a female specimen with the same labels. The male bears in addition Candèze's yellow-bordered label: n. sp. variatus Cand. Beng. P. Card. There is no doubt that these specimens are part of the syntype-series but they are not conspecific with the lectotype. They belong to a species at present unknown to me. It is not known whether the female in the MNHN, Paris recorded by Hayek (1973 : 228) is conspecific with the lectotype. A specimen without Candèze's determination label has been selected as the lectotype because it agrees better with the description than the one with the label, and it is known that in the course of curation labels have been transferred from one specimen to another by mistake.

Agrypnus variolus (Candèze) [p. 228]

Paralectotypes examined. 1 ex., Queensland; Lacon variolus Cd., det. E. Candèze (IRSNB curatorial label); Collection E. Candèze. 1 ex., Queensland; Collection E. Candèze; variolus Cand. ? Fleutiaux vid [Fleut.]; Lacon variolus Cd. det. E. Fleutiaux [IRSNB curatorial label] (IRSNB, Brussels).

Agrypnus zanzibaricus Hayek [p. 230]

The MCSN, Genoa collection contains a single male specimen with the following labels: Mombas. Viag. Raff. Acq. E. Deyrolle; Typus; marmoratus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189].

Whether this is the specimen to which Candèze refers is uncertain. The fact that the locality label refers to 'Mombas' rather than Zanzibar (see *Elasmosanus raffrayi* (Candèze), Hayek, 1973 : 107) prevents me from accepting it as the type without further investigation.

MERISTHUS Candèze [p. 231]

Subgenus *Sulcimerus* Arnett, 1955 : 617. Type-species: *Meristhus quadripunctatus* Candèze, by original designation.

Dr E. C. Becker (pers. comm.) is of the opinion, with which I agree, that as Fleutiaux did not designate a type-species for *Sulcimerus*, *Sulcimerus* Fleutiaux is invalid (I.C.Z.N. Art. 13(b)) and the genus must be credited to Arnett.

There are unfortunately several errors in the second part of the generic diagnosis. This should read: prothorax not constricted behind the anterior angles; lateral carinae attain the anterior margins; propleurae without (*Meristhus* s. str.) or with (subgenus *Sulcimerus*) depressions for the reception of the anterior tarsi; scutellum with distinct median longitudinal carina; tarsi simple, without ventral lobes.

The relationships of the genus are discussed in the Appendix (p. 251).

SPECIES INCLUDED IN THE GENUS [p. 232]. The generic attribution of *indecorus* Candèze and *ornatulus* Candèze have been confirmed. *Meristhus erinaceous* Candèze and *longicollis* Candèze are transferred to *Rismethus*. The genus includes 10 species.

Meristhus (Meristhus) angulicollis Fairmaire [p. 232]

Syntypes examined. MADAGASCAR: ♀, Madag. Perrier; Meristhus angulicollis Frm. n. sp. Madag. [Fairm.]; Type; Tilotarsus angulicollis Fairm. det. Fairmaire [IRSNB curatorial label] (IRSNB, Brussels). In my opinion the 5 specimens recorded previously (Hayek, 1973 : 323) should be regarded as syntypes.

Meristhus (Meristhus) squameus Candèze [p. 233]

Syntypes examined. ZAIRE: 2 ex., Boma, Congo; Collection E. Candèze; Meristhus squameus Cd. det. E. Candèze [IRSNB curatorial label]. One specimen bears in addition: Type; n. sp. squameus Cand. Boma Tschof. [Cand., blue border] (IRSNB, Brussels).

Meristhus (Sulcimerus) indecorus Candèze

Meristhus indecorus Candèze, 1892*c* : 485.

Syntypes examined. INDIA: 1 ♀, 1 ex., Bengale, Barwai; Collection E. Candèze; Meristhus indecorus Cd., det. E. Candèze [IRSNB curatorial label]. The ♀ bears in addition: n. sp. 1892 indecorus Cand. Bengal, Barwai P. C. [Cand., yellow label] (IRSNB, Brussels). The description is based on two specimens collected in Chota Nagpore (see Hayek, 1973 : 273) by Cardon.

Meristhus (*Sulcimerus*) *ornatulus* Candèze

Meristhus ornatulus Candèze, 1897 : 11.

Syntypes examined. INDIA: 1 ex., Barwai, Bengale; n. sp. 1893 ornatulus Cand. Barwai Bengale [Cand., yellow border]; Collection E. Candèze; Meristhus ornatulus Cd. det. E. Candèze [IRSNB curatorial label]. The abdomen is missing. 2 ex., Barwai; Collection E. Candèze; Meristhus ornatulus Cd. det. E. Candèze. One specimen lacks the abdomen (IRSNB, Brussels).

RISMETHUS Fleutiaux [p. 235]

The relationships of the genus are discussed in the Appendix (p. 251).

SPECIES INCLUDED IN THE GENUS [p. 235]. Six species are transferred to the genus which now includes 17 species.

Rismethus ceylonensis (Ohira) **comb. n.**

Meristhus ceylonensis Ohira, 1973*c* : 28, figs 1A & B.

Holotype. SRI LANKA: ♂, Prov. of Uva, Westminster Abbey, 25 mi ESE Bibile, 7.111.1962. Loc. 119 : 11. Sieved from debris (UZI, Lund). Not examined.

Paratypes. 7 ex., same locality (location not recorded).

Material examined. Paratype ♂, Ceylon, Prov. Uva Westminster Abbey 25 mls. ESE Bibile 7.iii.62. Loc 119 : 111 [sic]; sieved in debris; Lund University Ceylon Expedition 1962. Brink–Anderson–Cederholm (Ohira collection). 1 ♂ same locality (BMNH). This specimen does not bear Ohira's determination label but may nevertheless be part of the paratype series.

The wings are reduced to minute flaps and the metathorax is very short as in *squamiger* (Champion).

Rismethus diodesmoides (Motschulsky) [p. 236]

Meristhus biguttatus Candèze, 1893*b* : 30. Syntypes examined. WEST MALAYSIA: 3 ex., Perak; Collection E. Candèze; Meristhus biguttatus Cd., det. E. Candèze [IRSNB curatorial label]. One specimen bears two additional labels: biguttatus Cand. Perak St. [Cand., yellow border] (IRSNB, Brussels).

As there is no real evidence that the material from Perak in the BMNH was ever examined by Candèze it is not here included in the syntype series.

Rismethus echinus **nom. n.**

Meristhus erinaceus Candèze, 1897 : 11.
Rismethus erinaceus (Candèze) **comb. n.** [Junior secondary homonym of *Rismuthes erinaceus* (Candèze, 1874).]

LECTOTYPE (present designation). BORNEO: ♂, Brunei Borneo; n. sp. 1895 erinaceus Cand. Borneo [Candèze, yellow border]. Collection E. Candèze; Meristhus erinaceus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Candèze's second syntype, a male from Kina Balu [sic] (IRSNB, Brussels) is not conspecific with the lectotype. It is *R. erinaceus* (Candèze, 1874).

Rismethus longicollis (Candèze) **comb. n.**

Meristhus longicollis Candèze, 1897 : 11.

Syntypes examined. INDIA: 1 ex., Bengale; n. sp. 1893 longicollis Can [illegible] Bengale [Cand., yellow border]; Type; Collection E. Candèze; Meristhus longicollis Cd. det. E. Candèze [IRSNB curatorial label]. 1 ex., Barwai 1893; Collection E. Candèze; Meristhus longicollis Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels). The species was not described in 1893.

Rismethus lotharensis (Ohira & Becker) **comb. n.**

Meristhus lotharensis Ohira & Becker, 1973 : 464.

Holotype. NEPAL: ♂, Can. Nepal Exped. nr Birganj, Lothar, 450 ft, 8.ix.1967 (CNC, Ottawa, type no. 12916).

Paratypes. 21 ex., same locality as holotype, 8–12.ix.1967 (CNC, Ottawa and Aichi University Collection); 1 ex., same locality as holotype, 8.ix.1967; Brit. Mus. 1973 . 303 (BMNH).

Rismethus minusculus (Candèze) [p. 236]

Lectotype (designated by Hayek, 1973 : 236). BORNEO: ♀, Borneo Sarawak, 1865–66, Coll. G. Doria; Typus; minusculus Cand. [replacement label in unknown handwriting, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa).

Paralectotype. 1 ex., same locality as lectotype but without determination label (MCSN, Genoa).

Rismethus nepalensis (Ohira & Becker) **comb. n.**

Meristhus nepalensis Ohira and Becker, 1973 : 462.

Holotype. NEPAL: ♂, Can. Nepal Exped. Birganj, Lothar 450 ft. 12.ix.1967 (CNA, Ottawa type no. 12915).

Paratypes. 7 ex., same data as holotype; 2 ex., same locality, 8.ix.1967 (CNC, Ottawa and Aichi University Collection). 1 ex., same data as holotype. Brit. Mus. 1973 : 303 (BMNH).

Rismethus nigritulus (Candèze) [p. 237]

Lectotype (van Zwaluwenburg, 1959 : 355). SUMATRA: Giesbeni [? illegible] Lahat, Palemb. 18 24/4 74; n. sp. nigritulus Cand. Sumatra [Cand., yellow border]; Type; Collection E. Candèze, 1 Meristhus nigritulus Cd. det. E. Candèze [IRSNB curatorial label] (IRSNB, Brussels).

Paralectotypes. 1 ex., Sumatra; Collection E. Candèze; Meristhus nigritulus Cd. [IRSNB curatorial label]; 3. 1 ex., Sumatra, Palembang (MNHN, Paris).

The third specimen in the IRSNB, Brussels collection recorded by van Zwaluwenburg and labelled '2' by him is not part of the syntype-series. It seems to be one of the specimens from tobacco recorded by Fleutiaux (1895*b* : 167).

Rismethus sarawakensis (Ohira) **comb. n.**

Meristhus (*Meristhus*) *sarawakensis* Ohira, 1973*a* : 109.

Holotype. BORNEO: ♂, Sarawak, Bau District, Lake Area 30.viii.1959 (T. C. Maa) (BPBM, Honolulu). Not examined.

Paratype. 1 ex., same locality as holotype, 2.ix.1958 (T. C. Maa) (Ohira Coll.). Not examined.

The generic attribution is based on the following specimen kindly sent for examination by Dr Ohira: 1 ♂, Borneo, Sarawak, Kepit District, Merirai Valley 28–31.vii.1958 (*T. C. Maa*) (Ohira collection).

Rismethus squamiger (Champion) [p. 239]

Additional paralectotypes examined. 2 ex., Duenas, Guatemala G. C. Champion. Meristhus squamiger Champ. det. Champion (IRSNB curatorial label); BCA coll. III (1) Meristhus [printed] squamige [Champ.]; Biol. C. Amer. Don Godman & Salvin (IRSNB, Brussels).

The wings are reduced to minute flaps and the metathorax very short as in *ceylonensis* (Ohira).

TRIERES Candèze [p. 240]

Trieres Candèze, 1900 : 78 (3). Type-species: *Trieres ramitarsus* Candèze, by monotypy.
Triers Hayek, 1973 : 239. [Incorrect subsequent spelling.]

The relationships of the genus are discussed in the Appendix, p. 251.

Trieres ramitarsus Candèze [p. 240]

LECTOTYPE (present designation). AUSTRALIA: ♂, Australia; n. sp. 1892 ramitarsus Cdz. Austr. [Cand., red border]; Collection E. Candèze; Trieres ramitarsus Cd. det. E. Candèze [IRSNB curatorial label]; Lectotype v. Zwal. 1957 (IRSNB, Brussels).

Van Zwaluwenburg did not publish the lectotype designation.

LANELATER Arnett [p. 240]

The genus contains 80 species. The relationships of the genus are discussed in the Appendix, p. 251.

Lanelater fuscipes [p. 249]

Elater fuscipes Fabricius, 1775 : 211.
Agrypnus fuscipes subspecies *gigas* Fleutiaux, 1918*d* : 182 footnote. **Syn. n.**
Agrypnus fuscipes subspecies *convexicollis* Fleutiaux, 1918*d* : 182 footnote. **Syn. n.**

Elater fuscipes Fabricius. LECTOTYPE (present designation). INDIA: ♀ fuscipes [Fabricius] (Keil Collection, UZM, Copenhagen).

Paralectotype. 1 ♂ without labels standing beside the lectotype (Kiel Collection, UZM, Copenhagen). The head is missing and has been replaced by that of an *Onthophagus* Latreille (Scarabaeidae, Coprinae).

Fleutiaux (1918*d*) footnote runs as follows: 'Présente plusieurs formes, notamment deux à Ceylan, dont l'une, de grand taille, est presque terne, avec le pronotum fortement ponctué et les elytres distinctement striés (*gigas*) et l'autre, de taille moindre, brillante, à pronotum assez convex (*convexicollis*)'.

The DEI, Eberswalde contains 3 male *fuscipes* specimens from 'Sud Ceylon' determined as *Agrypnus fuscipes* v. *convexicollis* by Fleutiaux. Up to the present I have not seen any specimens determined as *gigas* by Fleutiaux.

As *L. fuscipes* (Fabricius) varies considerably in length, degree of convexity and puncturation of the prothorax and the striation of the elytra, I feel fully justified in the synonymy.

Lanelater gestroi (Candèze) [p. 249]

Lectotype. PAPUA NEW GUINEA: ♂, Nuova Guinea Fly River, L. M. D'Albertis 1876–77; Typus; ♂ 22; gestroi Candèze [replacement label in unknown hand, see *Adelocera acerbus* (Candèze) p. 189] (MCSN, Genoa). Length 24·5 mm.

Paralectotype. 1 ♂, PAPUA NEW GUINEA: Nuova Guinea Fly River, L. M. D'Albertis 1876–77; Agrypnus gestroi Cand., det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze (IRSNB, Brussels). Length 22 mm.

The exact locality is uncertain. D'Albertis went ashore at various points in the course of his two voyages up the Fly River (D'Albertis, 1877; 1880) but where the specimens were collected is not recorded. They may have been collected at any point between the mouth of the Fly River and about 5°30′ S, 141°30′ E, the highest point up the river which was reached on June 25th 1876. No additional specimens of *gestroi* are known to me.

Lanelater resectus (Candèze) [p. 261]

Holotype. NEW GUINEA: ♀ C. M. Type [indicates ex coll. Mniszech]; resectus Cdz. N. Guinea [Cand. yellow border]; Agrypnus resectus Candèze det. E. Candèze [IRSNB curatorial label]; Collection E. Candèze; Type; cf. Cand. Mon. 1. 1857 p. 45 (IRSNB, Brussels).

The specimen is 34 mm long compared with the published length of 36 mm, but otherwise it agrees well with the description. It is probable that the label bearing the name '*Agrypnus australasiae* Dup.' recorded by Candèze has been lost. As Candèze (1874 : 12) states that this is not an Australian species and that he has examined many specimens from New Guinea and the Moluccas I believe that the original locality, Australia, was erroneous and was based on Mniszech's name *australasiae*. *L. resectus* (Candèze) occurs throughout the islands of New Guinea and Moluccas.

Lanelater substriatus (Candèze) [p. 265]

Elater glabratus Gyllenhal, 1817 : 129, No. 175.
Agrypnus substriatus Candèze, 1857 : 25. **Syn. n.**

Elater glabratus Gyllenhal. LECTOTYPE (present designation). SIERRA LEONE: ♂, S. Leone Afzelius (NR, Stockholm). The specimen stands in the Schoenherr collection under the label: glabratus Gyllenh. Syn. 1 No. 34.

To the best of my belief the name *glabratus* has never been used in any subsequent publication. It does not appear in the Junk Catalogue (1925). The most recent use of *substriatus* was by Girard (1971 : 560). The case should be referred to the International Commission on Zoological Nomenclature for a decision under the Plenary Powers.

OCTOCRYPTUS Candèze [p. 266]

Re-examination of the *Octocryptus cardoni* Candèze material in the BMNH collection has shown that tibial spurs are present.

Crowson (1977) states that *Octocryptus* appears to have a close affinity to *Drapetes* Dejean. It is true that both genera possess unusually long trochanters on the front legs, but there it would seem the resemblance ends. *Drapetes* species do not have deep impressions on the metasternum for the reception of the middle tarsi. Deep grooves for the reception of the middle and hind tarsi similar to those of *Octocryptus* are found in *Aulonothroscus* Horn and *Pactopus* LeConte (Throscidae (Trixagidae)). The structure of the middle coxal cavity of *Octocryptus* differs from that of *Drapetes* in that the mesepimeron does not form part of the margin of the mid coxal cavity. The structure of the prosternopleural suture of the two genera also differs. In *Octocryptus* the posterior portion is open to accommodate the anterior tarsi while in *Drapetes* the anterior portion is open to receive the rolled antennae as in *Adelocera* and many *Agrypnus* species.

Unlike Crowson I do not believe that the absence of styli on the ovipositor is characteristic of the Agrypninae. In the majority of *Lacon* species examined (see p. 253) styli are present on the ovipositor.

In my opinion the systematic position of *Octocryptus* remains an enigma.

Octocryptus cardoni Candèze [p. 267]

Additional syntype-material examined. INDIA: 2 ♀, Barwai; Collection E. Candèze; Octocryptus cardoni Cd. det. E. Candèze [IRSNB curatorial label]. One specimen bears in addition: n. sp. 1892 cardoni Barwai Bengale P. Cand. [Cand., yellow border] (IRSNB, Brussels).

The location of the remaining two specimens is unknown.

Octocryptus coomani Fleutiaux [p. 267]

Additional paralectotype examined. VIETNAM: 1 ex., Tonkin, Lac Tho, Hoa Binh A. de Cooman; Collection Fleutiaux; Octocryptus cardoni Fleut. [Fleut.]; Cotype (IRSNB, Brussels).

Octocryptus radula Candèze [p. 267]

LECTOTYPE (present designation). SUMATRA: sex undetermined, Sumatra Padang; n. sp. radula Cand. Sumatra Pad. [Cad., yellow border]; Collection E. Candèze; Octocryptus radula Cdz. det. E. Candèze [IRSNB curatorial label]; Type; vii.1943 Fleutiaux vid. [Fleut.] (IRSNB, Brussels).

Acknowledgements [p. 269]

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Some notes on the collections consulted [p. 270]

Carter, Herbert James (1858–1940). First collection to NM, Melbourne. Types from second collection to AM, Sydney (McKeown, 1936 : 54) and the collection in his possession at the time of his death to ANIC, Canberra (Anderson, 1941 : ii).

Froggatt, W. W. (1858–1937). Collection now incorporated in the ANIC, Canberra (E. B. Britton, pers. comm.). The type-material of the species described by MacLeay (1888) is in the MacLeay collection in the ANIC, Canberra.

Guérin-Méneville, Felix Edouard (1799–1874). Elateridae to F. Monchicourt. Monchicourt's collection was acquired by R. de Bonnevil who retained some (unspecified material) and dispersed the rest via E. Deyrolle. Candèze (q.v.) acquired the Elateridae.

MacLeay, Sir William John (1820–1891). He published his papers under the name William MacLeay or sometimes William MacLeay Junior. On his determination labels and in letters he wrote his name Macleay. His collection was in the MacLeay Museum, University of Sydney but is now on permanent loan to the ANIC, Canberra. Hahn (1962) published a list of the designated type-specimens in the MacLeay Museum.

MacLeay (1872) published descriptions of new species based on specimens collected by Mr Masters, assistant Curator of the Australian Museum [Sydney] at Gayhdah, Queensland. Syntype-specimens of these species are preserved in the MacLeay and AM, Sydney collections.

Masters, G. (1837–1912). See MacLeay.

Miwa, Y. (Active between 1927 and 1940.) Type-material now in Taiwan Agricultural Research Institute, Taipei, Taiwan (H. Ohira, pers. comm.).

Panzer, Georg Wolfgang Franz (1755–1829). According to Eisinger (1919 : 91) nothing definite is known of the fate of Panzer's library and extensive collection of insects. Hieke (pers. comm.) states that some of Panzer's specimens, which do not have any distinctive label, may have been incorporated in the general collection of the NMHU Berlin when it was reorganized by Gerstaeker (see Hayek, 1973 : 275) or possibly F. A. F. Karsch.

Westermann, Bernt Wilhelm (1781–1868). In about 1805 he travelled to South Africa and Bengal and Java. His collection is in the UZM, Copenhagen. See Dohrn (1968).

Corrigenda to Hayek (1973)

Page 7	line 8	for '***TRIERS***' read '***TRIERES***'
	21	for '(Text-fig. 13)' read '(Text-fig. 11)'
	28	for '*Triers*' read '*Trieres*'

Page 8	6	for ‘***OPATELUS***’ read ‘***OPTALEUS***’
	18	for ‘(p. 190)’ read ‘(p. 90)’
22	6	for ‘Nearctic’ read ‘Neotropical’
23		after line 6 insert ‘*Brachylacon aethiopicus* (Candèze) Cobos, 1964 : 586’
28	line 36	delete ‘Kishii (1961 : 25)’
		for ‘Ohira (1934 : 10)’ read ‘(1954*a* : 10)’
	37	for ‘1969’ read ‘1969*a*’
39	39	for ‘Candèze, 1878*a*’ read ‘Candèze, 1878*b*’
40	28	for ‘***nebulosa***’ read ‘***nebulosus***’
80	4	after ‘(1857 : 18’ insert ‘& 47’
82	23	for ‘vhr.’ read ‘var.’
83	30	after ‘Candèze, 1874 :’ insert ‘15 &’
		after line 30 insert ‘*Lacon tenebrionoides* (Candèze) Fleutiaux, 1926 : 95.’
	line 31	for ‘♀’ read ‘♂’
84	16	for ‘Candèze’ read ‘(Candèze)’
	21	for ‘1877’ read ‘1887’
	27	for ‘1926 : 93’ read ‘1926 : 94’
91		throughout for ‘***OPATELUS***’ read ‘***OPTALEUS***’
92	line 28	for ‘1784’ read ‘1874’
97	4	for ‘Arancanorum’ read ‘Araucanorum’
99	22	for ‘p. 000’ read ‘p. 275’
104	4	for ‘*Diolobitarsus*’ read ‘*Dilobitarsus*’
110	18	for ‘1898*a* : 183’ read ‘1898*a* : 129’
119	15	for ‘405’ read ‘413’
120	5	for ‘Kalimpeza’ read ‘Kalimfeza’
121	4	after ‘Moupin’ insert ‘A. David’
123	14	for ‘(Candèz)’ read ‘(Candèze)’
125	25	after ‘1942 : 1’ insert ‘fig. 1’
128	32	for ‘***Lacon***’ read ‘***Agrypnus***’’
133	6	for ‘*Adeleocera*’ read ‘*Adelocera*’
134	24	after ‘BCA Col.’ insert ‘III’
138	line 24	for ‘1956’ read ‘1895*b*’
	31	for ‘Erichson’ read ‘(Erichson)’
139	3	for ‘MADASCAR’ read ‘MADAGASCAR’
	12	for ‘1879*a*’ read ‘1878*a*’
141	21	for ‘1881’ read ‘1882’
144	1	delete ‘**comb. n.**’
		after line 3 insert ‘*Agrypnus* (*Paralacon*) *costicollis* (Candèze) Ohira, 1971*d* : 205’
147		lines 5, 6, 17 for ‘*davidi*’ read ‘*davidis*’
149		line 32 delete ‘**comb. n.**’ and insert ‘Ohira, 1971*d* : 205.’
152		lines 10 to 20 for ‘*eximus*’ read ‘*eximius*’ throughout
155	line 26	for ‘1868*b*’ read ‘1878*b*’
168	31	for ‘Janson ms.’ read ‘Janson mss.’
170	30	for ‘1826’ read ‘1926’
174	29	for ‘to Plason by Vienna’ read ‘by Plason of Vienna’
180	1	for ‘***maculosus*** (Macleay)’ read ‘***maculatus*** (MacLeay)’
	2	for ‘Macleay’ read ‘MacLeay’
	10	for ‘***maculatus*** (Candèze)’ read ‘***maculosus*** (Candèze)’
190	7	for ‘**comb. n.**’ read ‘**nom. n.**’
194	30	for ‘*tubidus*’ read ‘*turbidus*’
200	17	for ‘Klug, 1835’ read ‘Klug, 1833’
205	16	for ‘Nomkanbah’ read ‘Noonkanbah’
206	10	for ‘*Tilostarsus*’ read ‘*Tilotarsus*’

Page		
	lines 31, 33	for '*sakaguchi*' read '*sakaguchii*'
207	line 1	for 'Fleuteaux' read 'Fleutiaux'
211	29	for 'Coiffs' read 'Colffs'
212	4	for '*sylvatica*' read '*silvatica*'
215	lines 21 to 23	for '*stictus*' read '*sticticus*' throughout
216	line 22	for 'Macleay, 1872' read '(MacLeay, 1872)'
223	15	for '*Adelocera truncatus* (Candèze)' read '*Adelocera truncatus* (Herbst)'
228	20	for 'Klug' read '(Klug)'
230	31	for 'Blackburn, 1985' read 'Blackburn, 1895'
231	13	for 'restricted' read 'constricted'
231	14	for 'with' read 'without'
	15	for 'without' read 'with'
	15	for 'tarsus' read 'tarsi'
236	10	for 'Candèze, 1893' read 'Candèze, 1893*b*'
237	10	for '(RSNB, Brussels)' read '(IRSNB, Brussels)'
239	throughout	for '*Triers*' read '*Trieres*'
	line 22	for '*ramitarsas*' read '*ramitarsus*'
249	line 25	for '(CMSN, Milan)' read '(MCSN, Genoa)'
251	lines 19, 21	for '(CMSN, Milan)' read '(MCSN. Genoa)'
257	line 13	for 'Fleutiaux (1911 : 475)' read 'Fleutiaux (1912 : 475)'
363	35	delete '*Lanelater scortecci* (Binaghi) Arnett, 1952 : 105'
	38	for 'Confirmation of Arnett's' read 'The'
268	2	for '***OPATELUS***' read '***OPTALEUS***'
269	2	for '***TRIERS***' read '***TRIERES***'
285	after line 9	insert '—— 1781. *Species Insectorum* **1** vii + 552 pp.' Hamburgi et Kilonii.
286	line 2	for '1911' read '1912.' After 80 insert '(1911)'
290	35	after 'LANE, M. C.' insert '1953'
293	line 6	for '1972*c*' read '1971*c*'
	after line 6	insert '—— 1971*d*. A list of elaterid-beetles from South Asia preserved in the Hungarian Natural History Museum, Part VI (Coleoptera). *Annls hist. natn. hung.* **63** : 205–216.'
	after line 28	insert PERRIS, E. 1877. *Larves de Coléoptères.* 590 pp., 14 pls. Paris. This work was originally published in two parts; 1876, *Annls Soc. linn. Lyon* **22** : 269–418 (=pp. 1–160) and 1877, *loc. cit.* **23** : 1–430 and plates (=pp. 161–590).'
298	column 1	line 12 for '81' read '82'
	2	after line 31 insert 'aurorata LeConte, 80'
	2	line 32 delete '80'
		33 for '323' read '332'
		51 for 'beauchenii' read 'beauchenei.'
299	1	line 13 for '1885*b*' read '1895*b*'
	1	16 for '1905*b* : 276' read '1905*b* : 278'
		after line 18, canescens insert 'cantaloubei Girard, 1962 : 222, Sulcilacon'
	2	line 29 for 'Elaston' read 'Elston'
		36 for '*cejaki*' read '*cejkai*'
		47 for 'chrysoprasa' read 'chrysoprasus'
301	column 1	line 44 for 'eximus' read 'eximius'
302	2	7 for 'himalayensis' read 'himalayanus'
		40 after 'Candèze, 1892*c*' insert '485'
303	2	line 36 for 'litiginosus' read 'litigiosus'

Page 304	1	after line 28 insert major Fleutiaux, 1889 : 139, variety of modestus Candèze'
		line 36 for '1903*a*' read '1903*b*'
		after line 42 insert 'massula Candèze, 1882 : 2, Adelocera'
	2	after line 29 after 'modestus' insert 'var. major'
		after line 41 for 'Lobotarsus' read 'Tilotarsus'
305	1	line 8 for 'myamoti' read 'myamotoi'
		21 after '*nesiotes* Van Zwaluwenburg' insert '141'
	2	line 12 for '(Ohira)' read '(Miwa)'
		line 19 for 'Opatelus' read 'Optaleus'
		49 for 'Boheman, 42' read 'Boheman, 43'
306	2	after line 17 'pubescens' insert 'pujoli Girard, 1969 : 223, Lobotarsus'
307	1	line 7 for 'rectangularis' read 'rectangulus'
		39 for 'rufopictus' read 'rufopiceus'
	2	22 for 'Schazrz' read 'Schwarz'
		after line 45 insert 'setosulus Schwarz, 1903*b* : 378, Lacon'
		line 48 delete 'setulosus Schwarz, 1903*b* : 378, Lacon'
308	1	line 31 for 'stictus' read 'sticticus'
		38 for 'subaurorata' read 'subaurata'

Appendix

On the groups of genera within the Agrypninae and the relationship between *Lanelater* and *Pyrophorus* and its allies

Golbach's establishment of the genus *Stangellus* again draws attention to the difficulty, if not impossibility, of defining Elaterid genera by means of the classic external characteristics such as the relative sizes of the second and third antennal segments and the length of the antennal groove.

On the basis of these characteristics *Stangellus* falls between *Adelocera* and *Lacon*. The antennae resemble those of the former while the antennal grooves are similar to those of the latter. Examination of the available material of *Stangellus* has shown that the aedeagus and female genitalia are of the same type as those found in the *Lacon* species so far examined (see p. 253).

Dajoz (1965) divided the Agrypninae into two tribes on the basis of the structure of the bursa copulatrix. While I believe that Dajoz' second tribe, the Agrypnini, contains two very disparate genera (*Agrypnus* and *Lanelater* of the present work), his proposal is none the less of great interest as it suggests that the female genitalia may be of considerable value in the major classification of the Elateridae.

Dajoz' tribe Laconini, with the single genus *Lacon*, is characterized by the absence of a spermatheca and the presence in the walls of the bursa copulatrix of a large transverse plate bearing spines of various sizes. A second similar but much smaller plate may also be present (Dajoz, 1965 : figs 1a, 1b). At the present time the genus *Lacon* includes 125 species. The female genitalia of 14 species have been examined (see list on p. 253) and in all the bursa resembles that figured by Dajoz although there are interspecific differences. In the males of these species the lateral lobes (parameres) are as long or longer than the median lobe (penis). Fifty-seven other species have been examined (see list on p. 254) and have been found to have the same type of aedeagus. The genitalia of the remaining species are at present unknown to me. The same types of aedeagus and female genitalia are found in *Danosoma* (4 described species, males of 4 and females of 4 species examined), *Dilobitarsus* (23 described species, males of 19 and females of 5 species examined), *Optaleus* (4 described species, males of 3 and female of 1 species examined), and *Stangellus* (3 described species, males of 2 species and the female of an undetermined species examined). The genitalia of only one sex of *Eidolus* (2 described species, male of *linearis* (Candèze) examined), *Candanius* (1 described species, female examined) and *Acrocryptus* (1 described species, female examined) are known to me but in each case the genitalia are of the *Lacon* type and I have little doubt that when specimens of the opposite sex become available for study they also will be found to have genitalia similar to those of *Lacon*.

On the basis of the structure of the bursa copulatrix and the aedeagus the *Lacon*-group of genera includes the following genera as defined in Hayek (1973) and the present work. The term tribe is intentionally not used as the groups of genera now proposed are tentative and probably not of equal rank.

Lacon Castelnau, *Danosoma* Thomson, *Dilobitarsus* Latreille, *Optaleus* Candèze, *Eidolus* Candèze, *Candanius* Hayek, *Acrocryptus* Candèze, *Stangellus* Golbach.

In addition to the characteristic genitalia, these genera have in common the structure of the middle coxal cavity and the absence of tibial spurs. Dajoz states that in *Lacon* the valves of the ovipositor are always furnished with styli. This is true of all the species examined with the exception of *pollinaria* (Candèze) and *nobilis* (Fall) in which styli are entirely absent. Unlike the other species examined these two species have stout strongly thickened valves.

The eight genera can be distinguished from one another by the key on p. 184. At present it is possible to assign every known species to an appropriate genus. However, since many of the characters used (the lateral margin of the prothorax, the length and depth of the antennal grooves, the relative lengths of the second and third antennal segments and the presence or absence of lobes on the tarsi) are known to be very variable within the family it seems very probable that when more material becomes available for study it will not be possible to justify the retention of all the genera.

How far the difference between the adult *Lacon*-group species and the species belonging to other groups is reflected in the larvae cannot be estimated at present. Both Dolin (1964) and Ohira (1962) distinguish between the larvae of *Lacon* and *Agrypnus*, Dolin by means of the shape of the frons and the size of the paired anal hooks and Ohira by the presence or absence of a spiracular sclerite. Costa (1977 : 8) states that the larva of *Dilobitarsus quadrituburculatus* Candèze is closely related to that of *Lacon parallelus* (Lewis) described by Dolin (1964 : 54). Unfortunately Perris' (1877 : 169(9)) description of the larva of *Danosoma fasciata* (Linnaeus) is not sufficiently detailed to show whether or how closely it resembles the larvae of *Lacon* species. The descriptions of the larvae of *Lanelater* (under the name *Agrypnus*) by Fletcher (1919) and Illingworth (1921) are too poor to enable any comparison to be made. The larvae of *Adelocera* must be regarded as unknown at the present time, see p. 253.

The remaining genera treated in this work are tentatively grouped as follows. The groups are intentionally not given any particular rank.

1. *Agrypnus*-group. Mesepimeron not forming part of the margin of the mesocoxal cavity (Hayek, 1973 : fig. 2). Tibial spurs absent. Spermatheca present. Bursa copulatrix bearing one or more rows of spines.

Agrypnus
and probably *Trieres*
Rismethus } ♀ genitalia not examined
Meristhus

Of the 499 known species of *Agrypnus* the larvae of only 6 species (*binodulus*, *cordicollis*, *fuliginosus*, *miyamotoi*, *murinus*, *scrofa*) have been described. These larvae differ from those of *Lacon*. The larva of *Meristhus* (*Sulcimerus*) *niponensis* Lewis described by Ohira (1962 : 32, pl. 7, figs E–G) resembles *Agrypnus* in that it lacks a spiracular sclerite but differs in the possession of a mandibular retinaculum. The larvae of *Trieres* and *Rismethus* are unknown.

2. *Adelocera*-group. Mesepimeron forming part of the margin of the mesocoxal cavity (Hayek, 1973 : fig. 3). Tibial spurs absent. Spermatheca present. Bursa copulatrix with or without spines, etc. but never with a single large plate bearing spines.

Adelocera
Scaphoderus
Elasmosomus
Hemicleus

These four genera have the same mid coxal cavity structure as the *Lacon*-group but differ from it in possessing a spermatheca and in the shape of the chitinous structures in the bursa copulatrix. In the two *Adelocera* species examined (*demissus* (Candèze) and *aethiopicus* (Candèze)) the walls of the bursa bear two irregularly shaped areas of spines. *Scaphoderus riehlii* Candèze seems not to have any kind of chitinous structures in the bursa. *Elasmosomus* (examined: 1 ♀, Ghana, 2.v.57 (*V. F. Eastop*) (BMNH)) and *Hemicleus* (examined: 1 ♀, Ngong, 6.43 (*van Someren*) (BMNH)) both possess a very distinctive palisade of short rods bearing spines encircling the bursa at about the middle of its length. The very different forms of the internal portion of the female genitalia suggest that this group should be regarded as no more than a convenient 'catch-all', the contents of which require further study to elucidate their true relationships.

The structure of the bursa seems to indicate that *Elasmosomus* and *Hemicleus* are more closely related to each other than to *Adelocera* and *Scaphoderus*.

The larvae of the *Adelocera*-group are unknown. Ohira (1962 : 32 [in Japanese but with a good figure]) described a *? Brachylacon* larva which may be an *Adelocera* species but the determination is too tentative to allow any conclusions to be drawn.

3. *Lanelater*-group. Mesepisternum and mesepimeron forming part of the margin of the mesocoxal cavity (Hayek, 1973 : fig. 1). Tibial spurs present. Spermatheca present. Bursa copulatrix generally with one or more pairs of plates and rows of spines (see Dajoz, 1964 : figs 2a & 2b) but in some species these are reduced or absent.

Lanelater

The female genitalia of *Lanelater* are similar to those of *Pyrophorus* figured by Costa (1975) and show the same range of interspecific variation, from two pairs of plates and three long chains of spines to no plates or spines. Further studies may show that *Lanelater* is more closely related to *Pyrophorus* and allied genera than to the Agrypnine genera of this work. In my opinion this would not be surprising. The only characteristic common to all the genera up till now included in the Agrypninae is the prosterno-pleural sutural groove for the accommodation of the antennae. The length and depth of this groove are known to differ in otherwise very similar species in almost every genus (*Acrocryptus* and *Optaleus* are exceptions). Even in *Lanelater* several species are known in which the groove is very shallow (*infuscatus* (Klug), *longicornis* (Gahan)). The fact that the prosternopleural groove is grooved to a greater or lesser extent in many other genera (e.g. *Calais*, *Elius*, *Melanotus*, *Propsephus*) suggests that this feature may have appeared on a number of different occasions in the course of the evolution of the Elateridae.

The theory that *Lanelater* may be more closely related to *Pyrophorus* than to the Agrypninae of this work is supported by the fact that *Lanelater* shares with the former but differs from the latter in the possession of the following characteristics: the structure of the middle coxal cavity, the presence of tibial spurs and a vestiture of setae instead of scales.

Up to the present time I have not been able to examine any *Lanelater* larvae and the extant descriptions (Fletcher, 1919 and Illingworth, 1921) are too poor to enable any comparison to be made with the larvae of *Pyrophorus* species.

The genitalia of the following species have been examined

Lacon atterimus (Candèze)	♂
aureosquamosa (Jagemann)	♂
auroratus (Say)	♂
aurulentus (Candèze)	♂, ♀
balachowskyi Girard	♂
boninensis (Ohira)	♂
brasiliensis (Castelnau)	♂
cantaloubei (Girard)	♂
chabannei (Guérin-Méneville)	♂
chilensis (Solier)	♂, ♀
cinctus (Candèze)	♂
coeca Candèze	♂
cribratus (Candèze)	♂
discoidea (Weber)	♂
dorsalis (Candèze)	♂
drusa (Marseul)	♂
fairmairei (Candèze)	♂
fleutiauxi (Schwarz)	♂
fulvipennis Fleutiaux	♂
funebris (Solsky)	♂
geographicus (Schwarz)	♂
graeca (Candèze)	♂, ♀
grisea (Schwarz)	♂
impressicollis (Say)	♂
inflatus (Candèze)	♂
insularis (Candèze)	♂, ♀
laticollis (Candèze)	♂
lepidopterus (Panzer)	♂, ♀
limbatus (Candèze)	♂
lithophilus (Candèze)	♂

longicornis (Champion)	♂
mekrani (Candèze)	♂
mexicanus (Candèze)	♂
modestus (Boisduval)	♂, ♀
nobilis (Fall)	♂ ♀
palliatus (Latreille)	♂
pectinatus (Candèze)	♂
pectinicornis (Champion)	♂
pectoralis (Fairmaire)	♂
pictus (Fleutiaux)	♂, ♀
pollinaria (Candèze)	♂, ♀
punctatus (Herbst)	♂, ♀
pyrsolepis (LeConte)	♂
quercus (Herbst)	♂, ♀
rorulenta (Le Conte)	♂
ruber (Perty)	♂, ♀
salvazei (Fleutiaux)	♂
setosus (Candèze)	♂
sparsus (Candèze)	♂, ♀
spurcus (Candèze)	♂
strangulatus (Fleutiaux)	♂
subcostatus (Candèze)	♂, ♀
subpectinicornis (Schwarz)	♂
tenebrionoides (Candèze)	♂
unicolor (Candèze)	♂
viettei Girard	♂
yayeyamana (Miwa)	♂
Danosoma brevicornis (Le Conte)	♂ ♀
conspersa (Gyllenhal)	♂ ♀
fasciata (Linnaeus)	♂, ♀
obtecta (Say)	♂, ♀
Dilobitarsus abbreviatus Candèze	♂, ♀
bicornis Candèze	♂
bidens (Fabricius)	♂, ♀
cariosus Candèze	♂
columbianus Candèze	♂
crux (Philippi)	♂, ♀
deyrollei Candèze	♂
eloini Candèze	♂
inopinus Candèze	♂, ♀
laconoides (Fleutiaux)	♂
lignarius Candèze	♂
nubilus Candèze	♂
pendleburyi Fleutiaux	♂
petiginosus Germar	♂
quadrituberculatus Candèze	♂
subsulcatus Candèze	♂
sulcicollis (Solier)	♂, ♀
tessellatus Candèze	♂
vitticollis (Fairmaire & Germain)	♂
Optaleus cribratus (Blanchard)	♂
limbatus Candèze	♂, ♀
paleolatus Candèze	♂
Stangellus bucheri Golbach	♂
minutus (Candèze)	♂
undetermined ♀, Jatahy, Goyaz (MNHN, Paris)	

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The majority of references will be found in Hayek (1973). The following are additions, corrections or were omitted in error.

† indicates reference omitted from Hayek (1973).

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Index

For species treated for the first time in the text, only the original spelling is shown for adjectival specific names whose endings are liable to change according to the generic gender. Where it is necessary to distinguish between species with the same name published in the same year by the same author, the original generic attribution is also given. Invalid names are in *italics*. Where a name appears more than once in the text the main entry (if any) is given in **bold**.

†indicates that the name was omitted from Hayek (1973).

abbreviatus Candèze 254
aberdarensis Fleutiaux 205
abreptus Candèze 205
acerbus Candèze 189, 191, 194, 204, 205, 206, 209, 213, 217, 221, 222, 223, 227, 228, 231, 240, 243, 246
acervatus Candèze 205
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A taxonomic revision of the genus *Deltophora* Janse, 1950 (Lepidoptera: Gelechiidae)

K. Sattler

Department of Entomology, British Museum (Natural History), Cromwell Road,
London SW7 5BD

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Synopsis

The genus *Deltophora* Janse with species on all continents is revised. The primary types of all but one of the discussed species have been examined. Nineteen species and two subspecies are regarded as valid. Thirteen new species and one new subspecies are described; one new synonym in the family group is established; one species is reduced to subspecies rank; one species is recalled from synonymy and six new generic combinations are introduced. Aspects of the suprageneric classification of the Gelechiidae and the systematic position of *Deltophora* are discussed. Keys to the species are provided and all species and their genitalia are described and illustrated. The tribe Metzneriini Piskunov, 1975, is synonymized with Aristoteliinae Heslop, 1938.

Introduction

The genus *Deltophora* was proposed by Janse in 1950 for a South African species; further species, including a number of undescribed ones, from the tropical to temperate zones of Africa, Europe, Asia, America and Australia now also have to be included in this genus.

I have examined the primary types of all nominal species included in this paper, with the exception of *peltosema* Lower of which I have seen only a photograph.

The literature on the subject was considered as completely as possible and about fifty publications dealing with *Deltophora* species are listed in the Bibliography (pp. 305–307). A complete bibliography for each species is recorded in my card index from which detailed information will be made available on request. Bibliographic references in the systematic part of this paper are confined to publications from which unchecked information was extracted for the present study or which contain taxonomic changes and other important information. Misidentifications which

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have been corrected by re-examination of the relevant specimens are also recorded. Excluded are, in particular, check-lists and faunistic papers unless they fall into one of the above categories.

The measurements at the beginning of each description are those of the fore wing length of the smallest and biggest specimen measured in millimetres from the base to the apex of the wing. In several instances the number of available specimens was limited and the variation in the size of those species may, of course, be greater than is indicated by the recorded measurements.

The photographs of the moths show the left-hand wings; where these were unsuitable for photography the right-hand wings were taken and the image was reversed.

The terminology of the genitalia follows Klots (1956). Details of the genitalia structures in *Deltophora* are discussed on pp. 271–273.

Under 'Distribution' only the countries are listed; however, if a species is restricted to a limited area of a country or if it is only known from one locality, this is expressed, for example, 'India (Punjab)' or 'E. Afghanistan'. All distribution records are based on material examined by myself unless stated otherwise. Each specimen is recorded in my card index and bears my determination label; type-specimens bearing full and unambiguous labels were merely recorded but not again labelled.

The spelling of locality names follows *The Times Atlas of the World* (Comprehensive Edn), 1968, unless there was good reason to proceed otherwise. If the spelling differs significantly from that on the specimen label, the latter is also cited, for example, 'Pul-i-Khumri ('Polichomri')'. When localities could be traced only with difficulty, detailed information is given, including the geographical latitude and longitude. The localities of some collectors are recorded in published locality lists, expedition reports or special papers (for example, Amsel, 1935 : 228; Essig, 1941; Kasy, 1964; 1965). Reference to such papers is made in the appropriate places.

The altitudes of localities (where recorded on the specimen labels) are uniformly cited in metres above sea level. Where the altitude is given in feet on a specimen label this is also cited, for example, '1800 m ('7000 feet')'. As almost all altitude data, particularly those on old labels, are merely estimates, they are converted to the nearest 50 m.

Distances are uniformly cited in kilometres. When the distance is given in miles on a specimen label this is also cited, for example, '32 km ('20 miles') . . .'. Distances up to 10 km are converted to the nearest 0·5 km, from 10 to 100 km to the nearest km, above 100 km to the nearest 10 km.

Abbreviations of museums and institutions

ANIC	Australian National Insect Collection, Division of Entomology, C.S.I.R.O., Canberra, Australia.
BMNH	British Museum (Natural History), London, U.K.
IAR	Institute for Agricultural Research, Samaru, Nigeria.
LN	Landessammlungen für Naturkunde, Karlsruhe, West Germany.
MCZ	Museum of Comparative Zoology, Cambridge, Mass., U.S.A.
MINGA	Muzeul de Istorie Naturală 'Grigore Antipa', Bucharest, Rumania.
MNHN	Muséum national d'Histoire naturelle, Paris, France.
MNHU	Museum für Naturkunde der Humboldt-Universität, Berlin, East Germany.
MZ	Museo de Zoología, Barcelona, Spain.
NM	Naturhistorisches Museum, Vienna, Austria.
NMNH	National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A.
SAM	South Australian Museum, Adelaide, Australia.
TM	Transvaal Museum, Pretoria, South Africa.
ZSBS	Zoologische Sammlung des Bayerischen Staates, Munich, West Germany.

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Remarks on the suprageneric classification of the Gelechiidae and the tribe Metzneriini Piskunov, 1975

The currently recognized classification of the Gelechiidae is essentially that proposed by Meyrick (1925) who primarily based it on the wing venation. Meyrick's nine genus-groups have since been given subfamily rank; his group 8 has been divided into the subfamily Brachmiinae and the three families Lecithoceridae, Symmocidae and Holcopogonidae. Meyrick's group 3 (subfamily Gelechiinae) has been subdivided into the three tribes Gelechiini, Gnorimoschemini and Teleiodini. These currently recognized suprageneric groupings are hardly comparable with each other and what one author considers a tribe is a separate family to another. For example, the genera around *Gnorimoschema* Busck were given tribe rank (Gnorimoschemini), whereas a comparable group of genera around *Symmoca* Hübner was accorded family rank (Symmocidae).

Most of the suprageneric divisions of the Gelechiidae are poorly defined and so are many of the 700–800 genera. It is not unusual to find genera placed in an incorrect subfamily or species of one genus scattered over several genera of different subfamilies. The genus *Deltophora*, the object of this paper, is no exception as will be seen below (p. 268). Studies during the past forty years have relied increasingly on genitalic characters, sometimes to the exclusion of the venation, and have led to numerous adjustments at the species and genus level. In recent revisions the genera are primarily based on characters of the male and female genitalia which permit more natural groupings than the venation. Gelechiid genera thus defined can clearly be identified morphologically and are frequently associated with particular host-plant groups (for example, *Ornativalva* Gozmány – *Tamarix* species; *Caryocolum* Gregor & Povolný – Caryophyllaceae; *Mirificarma* Gozmány – Leguminosae).

Recently, Piskunov (1975) proposed the tribe Metzneriini for the genera *Metzneria* Zeller, *Isophrictis* Meyrick, *Eulamprotes* Bradley, *Monochroa* Heinemann, *Paltodora* Meyrick, *Ptocheuusa* Heinemann, *Argolamprotes* Benander and *Pyncostola* Meyrick. He divided the Gelechiidae into the Gelechiini, Gnorimoschemini and Teleiodini, to which he added the Metzneriini as a fourth tribe, ignoring completely all previous subfamily divisions and overlooking that the mentioned three tribes are those of the subfamily Gelechiinae, whereas *Metzneria* and related genera belong to the Aristoteliinae.

In the Gelechiidae the wing venation is notoriously unstable, particularly in the apical region of the fore wing. In the typical gelechiid fore wing all radial and medial veins arise free from the cell, except R_4 and R_5 which share a common stalk. The stalking of M_1, and less frequently R_3, with R_{4+5} has developed several times independently, for example, in *Athrips* Billberg (=*Rhynchopacha* Staudinger) (Gelechiini), *Ephysteris* Meyrick (Gnorimoschemini), *Aproaerema* Durrant, *Syncopacma* Meyrick and related genera (Anacampsinae), and is of little value as a suprageneric character. According to Piskunov the Metzneriini are primarily characterized by the fore wing venation with R_5 and M_1 on a common stalk. This condition can only be confirmed for *Metzneria*, *Isophrictis* and *Ptocheuusa*, whilst in *Monochroa*, *Paltodora* and *Argolamprotes* M_1 arises free from the cell; in *Eulamprotes* M_1 was found stalked with R_5 in *wilkella* (Linnaeus) (=*pictella* Zeller) but separate in *atrella* ([Denis & Schiffermüller]). Thus the stalking of M_1 with R_5 is unsuitable as a character for separating a tribe Metzneriini as suggested by Piskunov.

Piskunov excluded *Aristotelia* Hübner from his new tribe and associated it with the *Dichomeris*-group instead. This is clearly unacceptable. In the Dichomerinae the structure of the first abdominal segments is specialized. The lateral margin of tergite 1 bears a sclerotized fold fused with a similar sclerotization which separates tergites 1 and 2 and extends along the lateral margin of tergite 2. In *Aristotelia* and the genera which Piskunov placed in the Metzneriini there is no sclerotization along the lateral margin of tergite 2 (Fig. 1). In the Metzneriini and *Aristotelia* the anterior margin of sternite 2 bears a pair of long apodemes which link the abdomen to the metathorax (Fig. 2); in the Dichomerinae no apodemes are present and the anterior margin of sternite 2 is developed into a pair of short corners. (The structure of the first abdominal segments is further discussed on p. 268). In the male genitalia the Dichomerinae are characterized by a highly specialized vinculum–saccus complex and an aedeagus with various lateral processes and strong cornuti; *Aristotelia* has a simple saccus and an aedeagus without strong cornuti and lateral processes. The female genitalia of the Dichomerinae are also highly specialized with a short ductus and a large corpus bursae with various strongly sclerotized folds; the ductus seminalis originates from the corpus bursae. In *Aristotelia* the ductus bursae is long, the corpus bursae spherical, with a single signum but without sclerotized folds; the ductus seminalis originates from the posterior parts of the ductus bursae at the colliculum. *Aristotelia* also differs from the Dichomerinae by the venation, labial palpi and other characters.

In several families of the Gelechioidea the antennal scape bears a pecten, usually a longitudinal row of long, narrow scales. On the inactive moth the antennae are extended backwards over or under the wings and the pecten then comes to rest over the eye. The function of such eye cover is unknown. In the Nepticulidae or other families where the scape is enlarged to a proper eye cap this may have a protective function, for example, in keeping high intensity light out; however, a thin pecten or a single isolated scale would hardly serve such a purpose. In the Gelechiidae antennal pectens are present in the Apatetrinae and some Gelechiinae (*Pexicopia* Common and related genera). A single deciduous scale is present on the scape of some Aristoteliinae, for example, *Monochroa rumicetella* (Hofmann), *hornigi* (Staudinger) and *Aristotelia brizella* (Treitschke), *subdecurtella* (Stainton), *mirabilis* (Christoph), while it is absent in other species of the same genera. The presence of a single erect scale on the scape of some species seems to link *Aristotelia* with *Monochroa* ('Metzneriini') rather than with the Dichomerinae which always lack an antennal pecten.

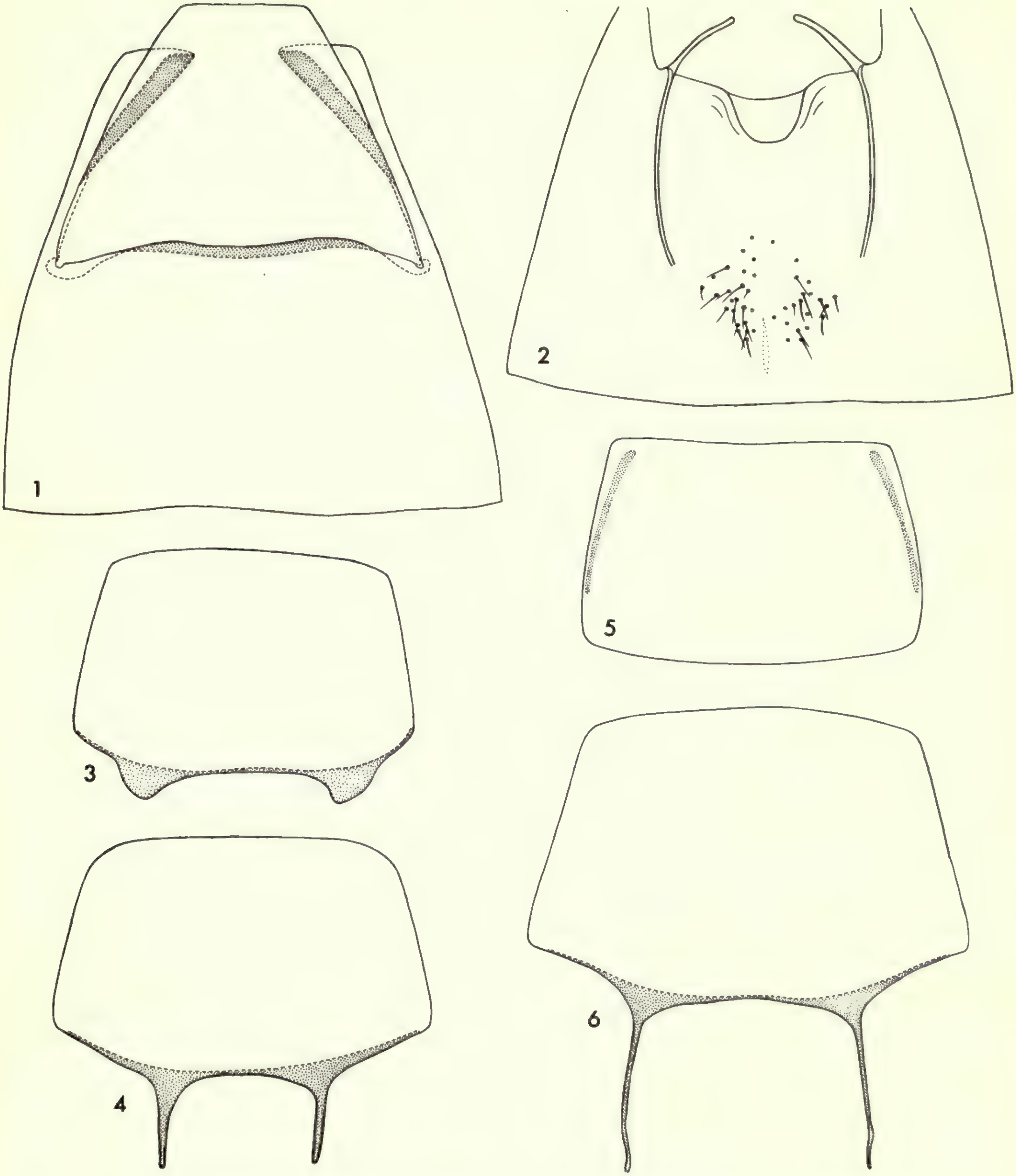
A further character linking *Aristotelia* with Piskunov's tribe Metzneriini and separating that genus from the Dichomerinae is the absence of the base of vein R_1 in the hind wing (see p. 271).

The only major character which seems to separate *Aristotelia* from the Metzneriini is the strong gnathos hook. However, even the presence of a gnathos in *Aristotelia* is not as important as it might look at first glance. The gnathos is part of the basic gelechiid structure and its absence in Piskunov's Metzneriini must be considered a secondary loss. Close examination shows a rudimentary gnathos to be present in *Eulamprotes atrella* ([Denis & Schiffermüller]), while remnants of gnathos arms are found in some *Monochroa* species and in *Deltophora*.

As shown above, Piskunov's opinion that *Aristotelia* is related to the Dichomerinae and that a new tribe is required for the genera associated with *Metzneria* cannot be confirmed. The tribe Metzneriini must therefore be placed in synonymy:

Aristoteliinae Heslop, 1938, *Cat. Br. Lepid.* : 78. Type-genus: *Aristotelia* Hübner, [1825].
Metzneriini Piskunov, 1975, *Ent. Obozr.* **54** : 857. Type-genus: *Metzneria Zeller*, 1839. **Syn. n.**
Metzneriidae Amsel, 1977 (nec Piskunov, 1975), *Beitr. naturk. Forsch. SüdwDtl.* **36** : 236. Unavailable name, see below.

Börner (1944 : 403) transferred *Metzneria* Zeller from the Gelechiidae to the Scythrididae: Scythridinae; however, this was universally rejected. Recently Amsel discussed Börner's view and, recognizing that *Metzneria* cannot be accommodated in the Scythrididae, proposed conditionally a separate family Metzneriidae (Amsel, 1977 : 236). He was apparently unaware that this latter name is antedated by Metzneriini Piskunov and is in any case unavailable because it is conditionally proposed (*Int. Code zool. Nom.*, Article 15). Börner's system of the Gelechioidea will be discussed in a separate paper.



Figs 1–6 1, 2, *Deltophora maculata* (Staudinger), first abdominal segments. (1) tergites 1 and 2. (2) sternite 2. 3, 4, *Monochroa* ♂, eighth abdominal sternite. (3) *M. tenebrella* (Hübner). (4) *M. nomadella* (Zeller). 5, 6, *Deltophora maculata* (Staudinger), ♂, eighth abdominal segment. (5) eighth tergite. (6) eighth sternite.

The structure of the first abdominal segments in the Gelechiidae

The importance of structures of the abdominal base for the classification of the Lepidoptera has been discussed by Börner (1939 : 1380). In the Gelechiidae the sclerites of the abdominal base provide useful characters for the suprageneric classification. The tergites 1 and 2 are not separated by an intersegmental membrane; their boundary is marked by a transverse sclerite which is usually narrow (Fig. 1) but sometimes dilated to a wide plate (for example in the Anacampsinae). Tergite 1 bears a pair of narrow lateral sclerites which may extend across the intersegmental boundary into tergite 2. Typically, sternite 2 bears a pair of sternal rods which approach the secondary arm of the metathoracic furca (Brock, 1971 : 42) and assist in linking the abdomen with the thorax. These sternal rods are composed of a free, anterior, apodemal part (sternal apodeme) and a longer posterior part which is merely a stronger sclerotization of the sternal cuticle (Fig. 2). In the Dichomerinae the structure of sternite 2 is rather different and no free apodemal appendages are developed.

In modern textbooks there exists some confusion over the terms ‘apodeme’ and ‘apophysis’; both are applied to invaginations of the integument which form part of the endoskeleton and serve as muscle attachments. Snodgrass (1935 : 68) terms any cuticular ingrowth of the body wall *apodeme* while using *apophysis* for ‘any tubercular or elongate process of the body wall, external or internal’. Kéler (1963 : 66) uses *apophysis* for all invaginations of the integument and restricts *apodeme* to apophyses of the pleural region. According to Chapman (1969 : 431, text-figs 284A, B) an *apodeme* is a hollow invagination of the integument while an *apophysis* is a solid one. Imms (1970 : 59) does not distinguish between *apodeme* and *apophysis* but applies the former to all individual parts of the endoskeleton.

In the Lepidoptera the free anterior appendages of sternite 2 developed undoubtedly as invaginations of the integument. In many instances it is hardly possible to decide whether the free anterior portion of the sternal rods is hollow or solid. The division of this structure into apodemes and apophyses on the basis of Chapman’s definition is therefore not practical; it is not even desirable, as the application of different terms to the same structure implies principal differences which in fact do not exist. It seems sensible to refer to the free anterior (hollow or solid) appendages of sternite 2 uniformly as sternal apodemes.

A group of sensory setae (sensilla trichodea) is found on the posterior third of sternite 2 (Fig. 2). In live specimens these setae touch the metathorax and record the position of the abdomen in relation to the thorax. A pair of setae of similar function is normally found on the anterior margins of abdominal sternites 3–7 (8), where they are overlapped by the preceding segment and the intersegmental membrane. The group of sensilla on sternite 2 and the pairs on the following sternites are found widely in the Lepidoptera. In some genera of the Gelechiinae: Teleiodini an additional group of setae exists on the anterior margin of sternite 2 (Sattler, 1964 : 90, text-fig. 3).

The systematic position of *Deltophora*

Previously known *Deltophora* species were originally described in such collective genera as *Aristotelia* Hübner, *Gelechia* Hübner, *Teleia* Heinemann and *Xenolechia* Meyrick. Subsequently, Meyrick (1925) and Gaede (1937) placed some of the species (*atacta* Meyrick, *korbi* Caradja, *maculata* Staudinger and *peltosema* Lower) in *Aristotelia* Hübner (Aristoteliinae), others (*glandiferella* Zeller and *stictella* Rebel) in *Telphusa* Chambers (Gelechiinae: Teleiodini). The association of some species with genera of the Teleiodini (*Teleia* Heinemann, *Telphusa* Chambers and *Xenolechia* Meyrick) may have been based on wing venation. The hind wing vein M_1 is stalked with *RR* in the Teleiodini, whereas those veins are usually separate in the Aristoteliinae (for example, *Apodia* Heinemann, *Argolamprotes* Benander, *Aristotelia* Hübner, *Eulamprotes* Bradley, *Merimnetria* Walsingham, *Metzneria* Zeller, *Monochroa* Heinemann and *Paltodora* Meyrick). It is strange that Meyrick, who placed great emphasis on the systematic importance of the venation, associated most of the *Deltophora* species more correctly with *Aristotelia* against the apparent evidence of the venation. It seems that *glandiferella*, which he placed in *Telphusa*, was unknown to him at the time (specimens in his collection date from 1926) and that in placing it he followed Busck (1903). Gaede's catalogue of 1937 is merely a compilation; he followed Meyrick (1925) in most instances and left subsequent species in the genera in which their respective authors had placed them. Spuler (1910 : 359) noticed the presence of ocelli in *maculata* and therefore excluded it from *Teleia*, without, however, assigning it to another genus.

When Janse (1950 : 121) described the genus *Deltophora* in his work on the South African Gelechiidae, he placed it between *Microsetia* Stephens and *Lanceopenna* Janse and compared it with *Aristotelia* Hübner, *Leuronoma* Meyrick, *Pyncostola* Meyrick, *Telphusa* Chambers and *Xenolechia* Meyrick.

Deltophora is here placed in the Aristoteliinae; it differs from all other genera of that subfamily by the stalked veins $RR+M_1$ of the hind wing. Within the Aristoteliinae it is placed next to *Monochroa* Heinemann with which it shares important characteristics of the abdominal structures of the male, for example, the anterior apodemes of the eighth sternite (Figs 3, 4, 6), the two pairs of coremata and the aedeagus with the lateral 'window' (Fig. 7).

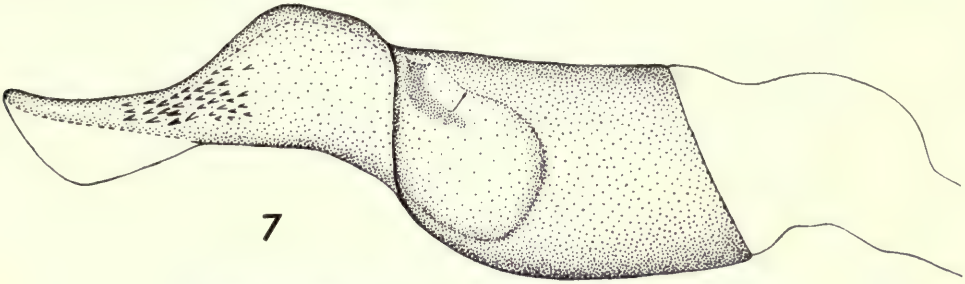


Fig. 7 *Monochroa divisella* (Douglas), ♂, aedeagus.

In the Aristoteliinae the eighth tergite and sternite of the male are laterally fused and not separated into free flaps as in the Gelechiinae. In *Deltophora* and *Monochroa* the eighth tergite is membranous but bears laterally a pair of narrow longitudinal sclerotizations (Fig. 5). The anterior margin of the eighth sternite of *Deltophora* bears a pair of long apodemes which extend anteriorly into the seventh segment (Fig. 6). In *Monochroa* such apophyses are absent in some species; in *conspersella* (Herrich-Schäffer), *tenebrella* (Hübner) (Fig. 3) and *tetragonella* (Stainton) a strengthening of the anterior margin is noticeable and small subtriangular processes are developed; in *rumicetella* (Hofmann) and *nomadella* (Zeller) (Fig. 4) short apodemes are present. A similar structure of the eighth abdominal segment is also found in the South American *Trichembola idiarcha* (Meyrick, 1931), which, in addition to the long apodemes of the eighth sternite, has another much shorter pair on the anterior margin of the seventh sternite (see Clarke, 1969, pl. 248, fig. 3c). In the Gelechiinae a short pair of apodemes is present on the anterior margin of the eighth abdominal sternite of '*Telphusa*' *inferialis* Meyrick, 1918. The eighth tergite bears a pair of coremata at its base and is not laterally fused with the sternite.

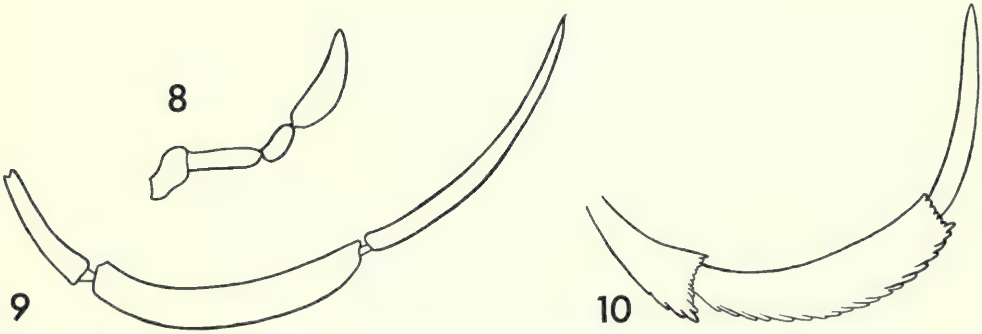
In many Aristoteliinae the aedeagus is plump and composed of a bulbous base with a narrower apical portion. In some genera (*Deltophora*, *Monochroa* and *Eulamprotes*) it is characterized by a lateral, slightly inflated 'window', which is less sclerotized than the surrounding area of the aedeagus wall (Fig. 7).

Deltophora differs from *Monochroa* (and other Aristoteliinae) by the presence of the basal section of vein R_1 and the stalking of RR with M_1 in the hind wing (Fig. 11), the presence of a well-developed, hook-like uncus in the male and the characteristic shape of the signum in the female.

DELTOPHORA Janse, 1950

Deltophora Janse, 1950, *Moths S. Afr.* **5** : 121; 1954, *ibidem* **5** : 449 [key]. Type-species: *Xenolechia peltosema* Lower sensu Janse, 1950 [= *Deltophora typica* sp. n.], by original designation and monotypy.
Deltophora Janse; Sattler, 1973 : 191.

Frons convex, without processes or other modifications. Ocellus present. Mandible about three-quarters length of basal segment of labial palpus. Proboscis well developed, squamose at base, about as long as labial palpus. Maxillary palpus (Fig. 8) with four segments. Labial palpus (Figs 9, 10) recurved, narrow, smoothly scaled; second segment without brush below; third segment about as long as second. Antenna shorter than fore wing, scape without pecten or single erect scale. Metascutum with paired group of narrow, hair-like scales. Venation (Fig. 11) of fore wing with veins R_4 and R_5 on common stalk; distance (at base) $R_1 - R_2$ equals $R_2 - R_3$; $R_{4+5} - M_1$ about half $M_1 - M_2$; cell between M_1 and M_2 open or closed. In hind wing veins RR and M_1 on common stalk of variable length, distance $RR+M_1 - M_2$ about twice distance $M_2 - M_3$; vein M_3 from lower angle of cell, separate from Cu_1. Frenulum of ♀ with three long setae. Humeral field (Fig. 11, H) on ventral surface of fore wing densely scaled, without microtrichia. Fore wing 3·5–7·5 mm, grey, grey-brown, ochreous or cream-coloured, with characteristic dark markings: spot in or on fold at about one-fifth to one-quarter (plical spot), often similar spots on costa and dorsal margin, forming incomplete transverse fascia; large spot in cell (discal spot) (Fig. 50), often extended to dorsal margin (Fig. 35) and rarely to costa as well (Fig. 42); small spot at end of cell, frequently extended to tornus; series of dark markings along costa; apical portion of wing sometimes darker than basal two-thirds; rarely wing markings reduced to three small spots in fold, cell and at end of cell (Fig. 51).



Figs 8–10 *Deltophora stictella* (Rebel), palpi. 8, maxillary palpus, denuded. 9, labial palpus, denuded. 10, labial palpus with scales.

Genitalia ♂ (Figs 65–83). Eighth tergite and sternite laterally fused, not separated into free flaps. Eighth tergite membranous, laterally with pair of narrow, sclerotized longitudinal bands (Fig. 5). Anterior margin of eighth sternite (Fig. 6) with pair of narrow apodemes which extend freely into seventh segment. Two pairs of coremata intersegmentally between eighth segment and genitalia (Figs 60–62): dense brushes of long, thin, hair-like scales in pair of membranous sacs which open laterally and extend deep into anterior segments of abdomen (in this paper referred to as 'anterior pair of coremata') and pair of ventro-lateral groups of shorter scales (here referred to as 'posterior pair of coremata'). Uncus usually a long simple hook, sometimes medially dilated and modified. Gnathos absent but weakly developed gnathos arms present in some species. Anterior margin of tegumen sometimes with deep characteristic emargination. Valva broad, sacculus large, clearly separated from valva or reduced and fused with valva. Anellus membranous, without specializations; in some species sclerotized juxta present. Saccus broad, about size of tegumen. Aedeagus (Figs 15, 16) ventrally sclerotized, dorsally membranous; basal portion inflated, bulbous; apical portion more extensively membranous, supported by ventral sclerotization or narrow rod on right-hand side. Sclerotization usually extends into ventral thorn or projection near apex. Vesica without cornuti. Anterior part of ductus ejaculatorius sometimes with large sclerotization (lamina) (Figs 71, 72).

Genitalia ♀ (Figs 84–113). Posterior margin of seventh segment sometimes with pair of sclerotized pleural pits (Figs 63, 64). Ovipositor with papilla analis elongate, weakly sclerotized; apophysis posterior about 1·5 times to 3 times length of apophysis anterior. Posterior margin of eighth segment with irregular row of widely spaced long setae. Eighth tergite medially membranous; apophysis anterior a short rod, as long as eighth segment. Eighth sternite medially membranous, often set densely with minute spines, anterior margin sclerotized. Ostium bursae in anterior half of eighth sternite; sometimes short sclerotized antrum present. Ductus bursae straight, narrow, evenly dilated from ostium to corpus bursae, rarely twice length of apophysis posterior. Narrow colliculum in posterior portion of ductus bursae near ostium; rarely sclerotization of colliculum extended (*minuta*) or ductus bursae with additional sclerotization (*duplicata*). Ductus seminalis starts at colliculum. Corpus bursae often clearly defined, sometimes transition between ductus and corpus bursae gradual. Inner surface of corpus bursae usually with minute spines, sometimes only anterior half of corpus bursae spined; rarely spines extending into extreme anterior portion of ductus bursae. Signum always present, usually strong hook which is met at right angle by scobinate base plate; concave surface of hook serrate in apical portion; sometimes signum reduced to sclerotized plate.

REMARKS. In the venation *Deltophora* is characterized by the stalked veins RR and M_1 of the hind wing. Their common stalk is variable in length; in some of the examined specimens it reaches nearly twice the length of the free end of M_1, although it is usually much shorter. In the holotype of *korbi* the veins RR and M_1 sit on a short common stalk in the right wing but are separate in the left wing. In the hind wing of most Lepidoptera vein R_1 is anastomozed with Sc. In the Gelechiidae the short section of R_1 which connects RR with Sc usually is distinctly developed. This section of R_1 is clearly present in *Deltophora* (Fig. 11); however, it is absent in all other examined genera of the Aristoteliinae (*Apodia* Heinemann, *Argolamprotes* Benander, *Aristotelia* Hübner, *Eulamprotes* Bradley, *Merimnetria* Walsingham, *Metzneria* Zeller, *Monochroa* Heinemann, *Paltodora* Meyrick and *Ptocheuusa* Heinemann).

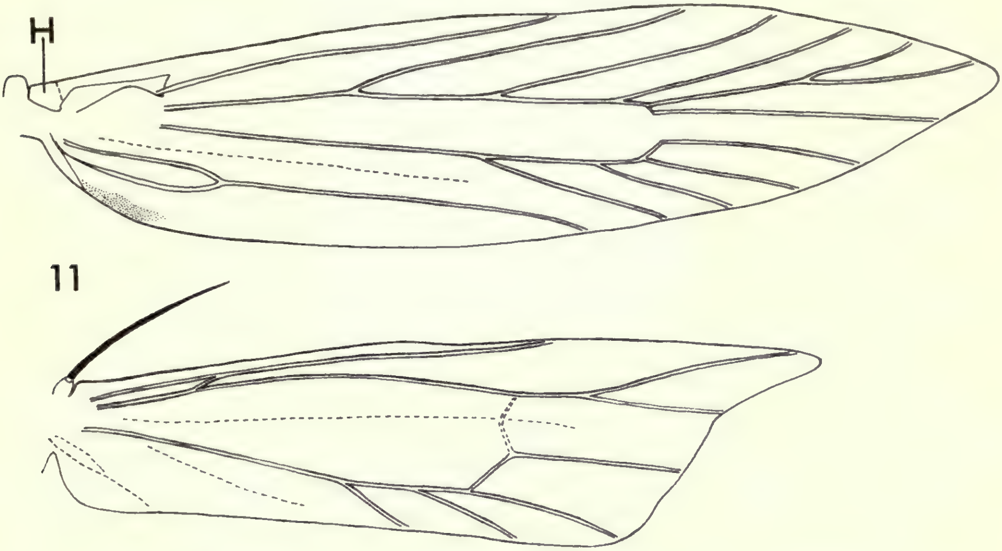


Fig. 11 *Deltophora stictella* (Rebel), ♂. Wing venation. (H – humeral field.)

The fore wing pattern of *Deltophora* is very characteristic and is shared by all species, except *sella atacta* and some specimens of *sella californica* in which the dark markings are reduced; in *beatrix* the markings are extended to wide transverse bands.

In the ♂ of most *Deltophora* species the entire area of the eighth tergite between the narrow lateral sclerotizations is evenly set with scale bases. In the *flavocincta*-group the eighth tergite is specialized. The lateral margin is convex and the sclerotized zone is wider than in the other groups. The lateral part of the tergite is slightly raised, the raised zone tapered posteriorly. The scale bases are particularly dense on the posterior half of the tergite, between the raised zones and on their apices. There are few scale bases on the anterior half of the tergite; the anterior part of the sclerotized lateral zones is completely without. This extreme degree of specialization is reached in *duplicata* and *lanceella*; intermediate stages with scale bases concentrated in certain places are found in *flavocincta*, *caymana* and *minuta*.

The apodemes on the anterior margin of the eighth sternite vary in length individually and between species. They are usually about as long as the preceding sternite but can be slightly shorter or up to one-third longer.

The coremata, which probably play an important role during courtship or mating, are usually hidden inside abdominal sacs. Both pairs are occasionally found everted in dried museum specimens; the anterior pair then protrudes as long white brushes (Fig. 12). The anterior pair reaches 2 to 3 times the length of the posterior pair; the length can vary in the same species. The scales of the posterior pair can be as narrow as those of the anterior pair but are usually much wider.

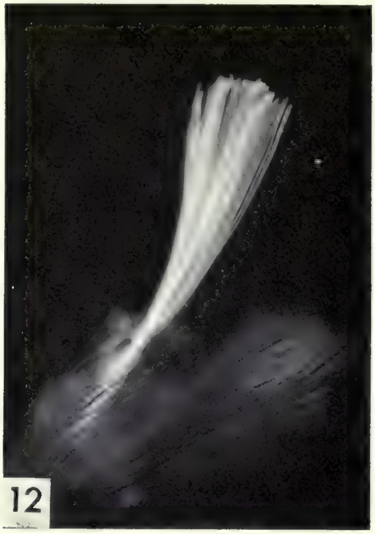


Fig. 12 *Deltophora typica* sp. n., ♂. Tuft of anterior pair of coremata.

In *duplicata* the anterior pair bears a group of strong, specialized scales, the longest of them with a characteristically curled apex (Figs 13, 62).

In some species of the *flavocincta*-group the uncus is inserted on the dorsum of the tegumen, not at its end. Rarely a weakly developed subscaphium is present (*flavocincta*, *lanceella*). In most species the anterior margin of the tegumen is emarginate. The shape and depth of the emargination are variable within and between species. In *caymana* and *minuta* the emargination is particularly deep and divides nearly the entire tegumen.

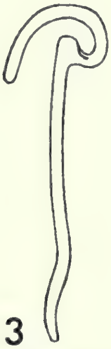


Fig. 13 *Deltophora duplicata* sp. n., ♂. Modified scale of anterior pair of coremata.

The aedeagus is divided into a bulbous base and a much narrower apical portion. The inflated basal portion is sclerotized, with the exception of a narrow dorsal zone which is membranous. The largely membranous apical portion is supported by a narrow, longitudinal, lateral or ventral, sclerotization which may be extended below the apex into a transverse ridge, thorn or pair of thorns. In the species of the *maculata*-group (*maculata*, *beatrix*) the anterior part of the ductus ejaculatorius bears a large sclerotization (lamina ducti ejaculatorii).

The description of the penis structure in Klots (1956 : 102) is incomplete; the illustrations (Figs 121, 123) are nebulous with regard to bulbus and ductus ejaculatorius. The bulbus ejaculatorius is not mentioned in the text. In the glossary (p. 191) it is defined as 'Distal part of ductus ejaculatorius, cephalad of the sclerotized aedeagus'; however, the term bulbus ejaculatorius should be restricted to the anterior portion of the penis, which forms a membranous sheath around the anterior portion of the proper ductus ejaculatorius. In the Gelechiidae the anterior part of the ductus ejaculatorius sometimes bears a sclerotization, here termed lamina ducti ejaculatorii, which can be of taxonomic importance (Fig. 14).

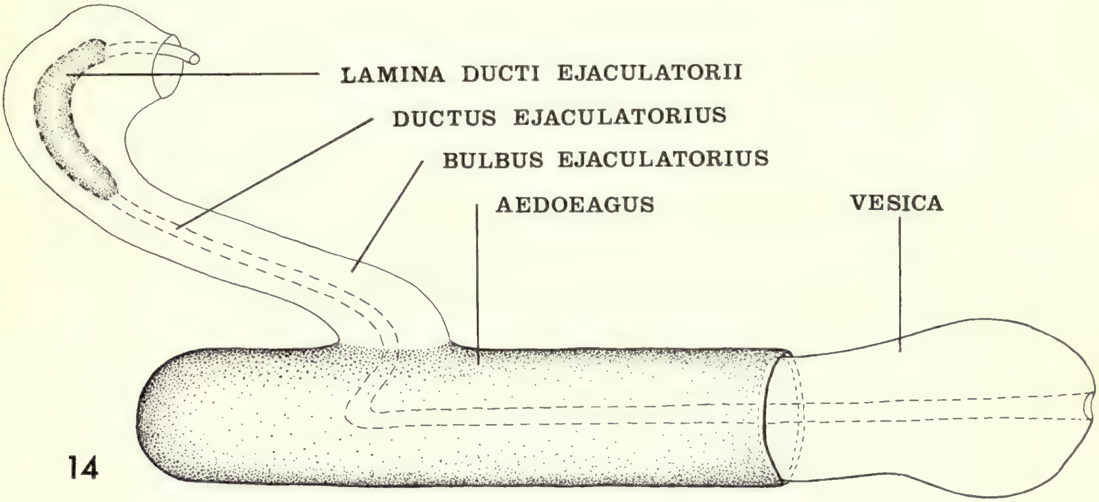


Fig. 14 Schematic diagram of gelechioid aedeagus.

In the ♀ of some species (*maculata*, *pauperella*, *glandiferella*, *minuta*) a pair of pleural pits is developed on the posterior margin of the seventh abdominal segment (Figs 63, 64). In some species of the *flavocincta*-group the pleural region shows a denser than usual concentration of scale bases; however, where this region is invaginated to pleural pits it is devoid of scales.

The bursa copulatrix is usually divided into ductus and corpus bursae; occasionally the bursa copulatrix widens directly from the colliculum and there is no separation into ductus and corpus bursae. The posterior part of the ductus bursae, between colliculum and ostium bursae, is usually dilated, funnel-shaped, and can be membranous or sclerotized. It is referred to as antrum if it is in any way specialized (dilated or sclerotized). The ductus bursae between colliculum and corpus bursae is usually straight; in *flavocincta* it has one loop in the middle. In the systematic part of this paper the length of the ductus bursae is compared with that of the apophyses posteriores. As the length of both structures is variable, the proportions given are approximate. The minute spines on the inner surface of the corpus bursae are sometimes difficult to see. It is therefore recommended to stain the genitalia, sever the intersegmental membrane between abdominal segments seven and eight and remove the bursa copulatrix from the abdomen. The practice of leaving the bursa copulatrix inside the abdomen may be more convenient for the preparator; it is, however, less satisfactory.

The type-species of *Deltophora*, *Xenolechia peltosema* Lower sensu Janse, 1950, is a misidentification. Under the *International Code of Zoological Nomenclature*, Article 70(a), the case of a misidentified type-species has to be referred to the International Commission on Zoological Nomenclature. The nominal species cited by Janse and the one actually involved are congeneric and closely allied. In view of Janse's detailed description and illustrations, which clearly permit identification, the Commission should be asked to designate formally as the type-species of *Deltophora* Janse, 1950, the nominal species actually involved, *Deltophora typica* sp. n.

Biology. Host-plants unknown. Based on the incorrect assumption that *peltosema* is a widely distributed species (Australia, India, Africa, South America), Meyrick suspected it to be 'attached to some garden plant' (Meyrick, 1908 : 724) and 'carried by man with some cultivated plant' (Meyrick, 1931 : 278). Most Aristoteliinae are internal feeders. The larvae of *Metzneria* Zeller, *Isophrictis* Meyrick, *Apodia* Heinemann and others live in the seed heads of Compositae. The larvae of *Monochroa* Heinemann, the genus closest to *Deltophora*, are leaf miners or stem and root borers on Cyperaceae, Polygonaceae, Rosaceae and Primulaceae. It seems probable that the *Deltophora* larvae are also internal feeders; however, at this stage no possible host-plant families can be suggested.

Little is known about the habits of the moths; they are nocturnal and are readily attracted to light. In southern Africa moths of *typica* were collected throughout the year; in areas with more extreme seasons one or two clear-cut generations per year can be expected.

Distribution. The genus *Deltophora* is distributed from the tropical to the temperate zones, between 50° N and 30° S, in all the major zoogeographical regions (Palaearctic, Ethiopian, Oriental, Australian, Nearctic and Neotropical). The distribution of individual species is much more limited, with each region having its own species.

Key to the species of *Deltophora*: males

(*Note*. The males of *pauperella* and *suffusella* are unknown.)

1		Uncus a slender hook, simple	2
–		Uncus distinctly dilated medially	15
2	(1)	Valva with two digitate processes (Fig. 80)	***duplicata*** (p. 301)
–		Valva without digitate processes	3
3	(2)	Sacculus large, clearly separated from valva	4
–		Sacculus small, not separated from valva	10
4	(3)	Sacculus tapered, pointed, almost as long as valva; uncus longer than tegumen (Figs 66, 67)	5
–		Sacculus broad, distinctly shorter than valva; uncus not longer than tegumen	6
5	(4)	Apical portion of aedeagus evenly curved (Fig. 67)	***angulella*** (p. 279)
–		Apical portion of aedeagus with distinct ventral projection (Fig. 66)	***diversella*** (p. 278)
6	(4)	Saccus more or less pointed	7
–		Saccus rounded or truncate (Figs 69, 70)	9
7	(6)	Distal margin of sacculus setose; sclerotized juxta present (Fig. 79)	***flavocincta*** (p. 300)
–		Ventral margin of sacculus setose; juxta absent (Figs 65, 68)	8
8	(7)	Ventral margin of sacculus straight or concave; apex of aedeagus blunt (Fig. 65)	***typica*** (p. 276)
–		Ventral margin of sacculus convex; apex of aedeagus with sharp ventral thorn (Fig. 68)	***peltosema*** (p. 279)
9	(6)	Distal margin of valva straight (Fig. 69)	***distinctella*** (p. 281)
–		Distal margin of valva concave (Fig. 70)	***fasciella*** (p. 282)
10	(3)	Valva strongly constricted medially; costal margin concave (Figs 28, 73)	***stictella*** (p. 289)
–		Valva medially not constricted; costal margin straight	11
11	(10)	Costal and ventral margin of valva almost parallel; distal margin concave (Figs 30, 74)	***korbi*** (p. 291)
–		Valva distally rounded, ventral margin angled (Figs 75–78)	12
12	(11)	Ventral angle of valva with sharp point (Figs 75–77)	13
–		Ventral angle of valva with rectangular sclerotization (Figs 34, 78)	***glandiferella*** (p. 297)
13	(12)	Fore wing with large dark discal spot (Figs 50, 52)	14
–		Fore wing unmarked or only with minute dark spots (Fig. 51)	***sella atacta*** (p. 296)
14	(13)	Discal spot of fore wing reaches dorsal margin (Fig. 52)	***sella californica*** (p. 297)
–		Discal spot of fore wing not reaching dorsal margin (Fig. 50)	***sella sella*** (p. 294)
15	(1)	Apex of uncus blunt (Figs 17–26, 71, 72); anterior part of ductus ejaculatorius with large sclerotized lamina (Figs 71, 72)	16
–		Uncus pointed; ductus ejaculatorius without sclerotization	17
16	(15)	Uncus strongly dilated near middle (Figs 17–26); valva widest near middle (Fig. 71)	***maculata*** (p. 283)
–		Uncus widest near base, gently tapered posteriorly; valva widest at distal quarter (Fig. 72)	***beatrix*** (p. 287)

17 (15)	Base of valva with sclerotized process (Figs 81, 83)	18
–	Base of valva without process	19
18 (17)	Valva tapered (Fig. 81)	***lanceella*** (p. 302)
–	Margins of valva parallel (Fig. 83)	***minuta*** (p. 304)
19 (17)	Uncus broad, leaf-shaped (Fig. 82)	***caymana*** (p. 303)
–	Uncus narrow (Fig. 79)	***flavocincta*** (p. 300)

Key to the species of *Deltophora*: females

(*Note*. The females of *angulella*, *beatrix*, *korbi* and *caymana* are unknown).

1	Signum strongly curved, hook-like (Figs 84–90, 101, 102, 105–108, 112, 113)	2
–	Signum neither hook-like nor curved	10
2 (1)	Ductus bursae with sclerotization anterior to colliculum (Figs 105, 111)	3
–	Ductus bursae membranous except for narrow colliculum	4
3 (2)	Eighth segment with ventral pair of large, ear-like lobes (Fig. 111)	***suffusella*** (p. 304)
–	Ventral surface of eighth segment without lobes (Fig. 105)	***duplicata*** (p. 301)
4 (2)	Apical part of signum compressed, much longer than basal part (Figs 107, 108)	***lanceella*** (p. 302)
–	Apical part of signum circular in cross-section, not longer than basal part (Figs 84–90, 101, 102)	5
5 (4)	Apophyses anteriores bent at base, inserted medially near ostium bursae (Fig. 101)	***glandiferella*** (p. 297)
–	Apophyses anteriores straight, inserted laterally on eighth segment	6
6 (5)	Ventral margin of ostium bursae with deep median emargination and pair of lateral folds (Fig. 85)	***diversella*** (p. 278)
–	Ostium bursae without lateral folds	7
7 (6)	Ostium bursae almost as wide as eighth sternite (Figs 87, 88)	8
–	Ostium bursae much narrower than eighth segment (Figs 84, 90)	9
8 (7)	Ventral margin of ostium bursae medially concave (Fig. 87)	***peltosema*** (p. 279)
–	Ventral margin of ostium bursae posteriorly straight or slightly convex (Fig. 88)	***distinctella*** (p. 281)
9 (7)	Discal spot of fore wing extended from costa to dorsal margin (Figs 41, 42)	***fasciella*** (p. 282)
–	Discal spot of fore wing not reaching costa (Figs 35, 36)	***typica*** (p. 276)
10 (1)	Ductus bursae with long sclerotization from colliculum (Fig. 109)	***minuta*** (p. 304)
–	Ductus bursae without sclerotization except for colliculum	11
11 (10)	Posterior margin of seventh abdominal segment with pair of sclerotized pleural pits (Fig. 63)	12
–	Seventh abdominal segment without pleural pits	13
12 (11)	Ventral margin of ostium bursae concave (Fig. 95)	***pauperella*** (p. 288)
–	Ventral margin of ostium bursae with subtriangular extension (Figs 91–94)	***maculata*** (p. 283)
13 (11)	Signum a strong straight spine (Figs 98–100)	14
–	Signum not a straight spine	16
14 (13)	Fore wing with large discal spot (Figs 50, 52)	15
–	Fore wing unmarked or only with minute dark spots (Fig. 51)	***sella atacta*** (p. 296)
15 (14)	Discal spot of fore wing reaches dorsal margin (Fig. 52)	***sella californica*** (p. 297)
–	Discal spot of fore wing not reaching dorsal margin (Fig. 50)	***sella sella*** (p. 294)
16 (13)	Ventral margin of ostium bursae posteriorly convex; signum a deep invagination at entrance of corpus bursae (Figs 29, 96, 97)	***stictella*** (p. 289)
–	Ventral margin of ostium bursae concave; signum a slightly curved, compressed blade with broad base (Figs 103, 104)	***flavocincta*** (p. 300)

Check-list of the species of *Deltophora*

DELTOPHORA Janse, 1950

***peltosema*-group**
- ***typica* sp. n.**
- ***diversella* sp. n.**
- ***angulella* sp. n.**

peltosema (Lower, 1900)
  pyramidophora Turner, 1919
distinctella **sp. n.**
fasciella **sp. n.**

maculata-group
maculata (Staudinger, 1879), **comb. n.**
beatrix **sp. n.**
pauperella **sp. n.**

stictella-group
stictella (Rebel, 1927), **comb. n.**

korbi-group
korbi (Caradja, 1920), **comb. n.**

glandiferella-group
sella sella (Chambers, 1874), **sp. rev., comb. n.**
sella atacta (Meyrick, 1927), **stat. n., comb. n.**
sella californica **subsp. n.**
glandiferella (Zeller, 1873), **comb. n.**

flavocincta-group
flavocincta **sp. n.**
duplicata **sp. n.**
lanceella **sp. n.**
caymana **sp. n.**
minuta **sp. n.**
suffusella **sp. n.**

The *peltosema*-group

GENITALIA ♂. Uncus hook simple. Valva distally dilated, with ventral point. Sacculus well developed, separated from valva by deep incision. Juxta absent. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀. Posterior margin of seventh abdominal segment without pleural pits. Antrum sclerotized or membranous. Inner surface of corpus bursae with minute spines. Signum of typical shape: strong hook, concave surface serrate; scobinate base plate branches off basal third.

DISTRIBUTION. Africa; S.W. Asia; Australia.

Deltophora typica sp. n.

(Figs 12, 35, 36, 65, 84)

[*Aristotelia peltosema* (Lower); Meyrick, 1908 : 724 (partim). Misidentification.]
[*Aristotelia peltosema* (Lower); Janse, 1917 : 178. Misidentification.]
[*Deltophora peltosema* (Lower) Janse, 1950 : 119, 122, pl. 51, fig. 12, pl. 55, fig. 5, pl. 56, fig. 2, pl. 57, figs 3, 4, pl. 58, figs 2, 3, 8, pl. 59, fig. 2. Misidentification.]

♂, ♀. 4·5–5·5 mm. Head ochreous, some dark brown scales on margin of eye between bases of proboscis and antenna. Labial palpus pale ochreous; outer surface of basal segment with some dark scales on apex; second segment with incomplete dark brown rings near base and before apex; third segment with dark apex and dark brown ring around middle. Antenna brown, with lighter rings above. Thorax ochreous, posterior half to varying degree dark brown. Tegula ochreous, with dark brown base. Fore wing ochreous, with dark brown markings: series of fine markings on costa; some dark scales near base of dorsal margin; plical spot at one-quarter, triangularly extended to dorsal margin; discal spot extended to dorsal margin; small spot at end of cell. Apex of fore wing sometimes with darker scales.

GENITALIA ♂ (Fig. 65). Uncus hook simple, as long as tegumen. Anterior margin of tegumen medially with deep tapered emargination. Valva distally dilated; costal margin with obtuse angle at one-third, distal two-thirds straight; distal margin slightly convex, at right angles to costa; distal part of valva extended ventrad to form broad apex. Sacculus separated from valva by deep emargination, broad, subtriangular, ventral margin straight, setose. Saccus rounded, about one-third size of tegumen. Basal two-thirds of aedeagus inflated, sclerotized; apical third narrower, membranous, supported by narrow lateral sclerotization; apex with small ventral projection. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Fig. 84). Apophysis posterior about 1·5 times length of apophysis anterior. Eighth sternite membranous, densely set with minute spines, narrow zone on anterior margin sclerotized; anterior margin convex. Ostium bursae near anterior end of eighth sternite, about one-third width of sternite, ventral margin slightly concave. Antrum a short sclerotized pouch, anteriorly rounded. Narrow colliculum touches antrum. Ductus bursae about twice length of apophysis posterior, at entrance of corpus bursae twice as wide as at colliculum. Corpus bursae spherical, inner surface with minute spines which extend into extreme anterior portion of ductus bursae. Signum in anterior part of corpus bursae, a strong hook, concave surface of apical portion serrate; base plate elongate, scobinate.

REMARKS. *D. typica* is externally similar to *diversella* which sometimes occurs in the same areas. In *typica* the dark dorsal spot at the basal quarter of the fore wing is more strongly developed than in *diversella*; the latter has a distinct dark mark at the third quarter of the costa, whereas in *typica* there is at best a weak shadow. The genitalia of *typica* differ from those of *diversella* by the shorter uncus, the broad valva and sacculus and the simple apex of the aedeagus of the ♂ and by the simple structure of the ostium in the ♀.

The ♂ and ♀ genitalia are similar to those of *peltosema*, *distinctella* and *fasciella*. In the *peltosema* ♂ the valva is much narrower, the ventral margin of the sacculus is convex and the apex of the aedeagus bears a distinct ventral spine; in the ♀ the ostium bursae is about as wide as the eighth sternite and has a distinct median emargination. In the *distinctella* ♂ the distal part of the valva is twice as wide as its narrowest part near the middle (only about 1·5 times in *typica*), the sacculus is distally rounded or truncate (not pointed) and the aedeagus bears a big ventral thorn below the apex; in the ♀ the ostium bursae is as wide as the eighth sternite and leads into a large antrum. In the *fasciella* ♂ the ventro-distal corner of the valva is extended into a short robust point, the sacculus is distally rounded and the apex of the aedeagus bears a strong ventral point; in the ♀ the antrum is membranous, the signum is big and arises in the posterior part of the corpus bursae.

In Nigeria *typica* was first found by Medler in 1970 and 1973 and subsequently by Deeming in 1975. The absence of this species in their earlier collections could indicate that it is a recent accidental introduction in that country. However, after completion of this manuscript I have seen a specimen of another, as yet unidentified, species from Ghana, so that in all probability the genus *Deltophora* occurs naturally in the West African fauna.

The collecting sites of the British Museum (Natural History) Southern African Expedition are identified by a number on the data labels of the specimens. Photographic records and detailed information on these sites are available in the diaries of the members of the expedition. The site number is recorded below under 'Material examined'.

I was unable to trace some of the localities on the data labels of specimens in the Transvaal Museum. Most of them may be the names of farms in the Transvaal.

BIOLOGY. Host-plant unknown. In southern Africa the moths appear to fly throughout the year. In Nigeria moths have been collected in January and October.

DISTRIBUTION. Nigeria; South West Africa; South Africa; Rhodesia; Mozambique.

MATERIAL EXAMINED.

Holotype ♂, **South Africa**: Natal, Weenen, Eastcourt, Kimbolton, 1892 (*Hutchinson*) (genitalia slide no. 14 849; BMNH).

Paratypes. **Nigeria**: 1 ♀, N. Nigeria, Zaria, Samaru, 17.x.1975 (*Deeming*) (IAR, Samaru); 1 ♂, 1 ♀, Western State, Ile-Ife, 15.i.1970, 27.i.1973 (*Medler*) (BMNH). **South West Africa**: 13 ♂, 5 ♀, Abachaus, [260 km N. of Windhoek,] xii.1942, i-vii.1943, ii, xii.1944 (*Hobohm*) (TM, Pretoria; BMNH); 2 ♀, Kahn River, 8 km ('5 miles') N. of Usakos, at light, 30–31.i.1972 (*BMNH Sth. Afr. Exped.*, no. 29) (BMNH). **South Africa**: 1 ♂, Eastern Cape Province, Kei River Bridge, 5–6.ii.1955 (*Janse*) (TM, Pretoria); 2 ♂, Natal, Weenen, Eastcourt, 1892, 1895 (*Hutchinson*) (BMNH); 1 ♂, Natal, near Ladysmith, xii.1931 (*Janse*) (TM, Pretoria); 1 ♂, Natal, Colenso, 27.iii.1902 (collector unknown) (TM, Pretoria); 4 ♂, Transvaal, Pietersburg, Naawport, 22, 27.xi.1927 (*van Son*) (TM, Pretoria); 2 ♂, Transvaal, [N. Pretoria,] Naboomspruit, 8, 10.i.1927 (*van Son*) (TM, Pretoria); 30 ♂, 5 ♀, Transvaal, North Pretoria, 12.ii.1914–

4.ii.1918 (*Swierstra*) (TM, Pretoria; BMNH); 17 ♂, 6 ♀, Transvaal, Pretoria, 21.viii.1906–20.v.1924, 2.ix.1948, 5.iv.1949 (*Burger*; *J.G.*; *Janse*; *Swierstra*; *van Son*; *Vári*) (TM, Pretoria); 4 ♂, Transvaal, Pretoria, Zoutpan, 4–10.ii.1929 (*van Son*) (TM, Pretoria); 2 ♂, Transvaal, [Pilgrims Rest:] Marieps Mnt., 7.xii.1925 (*van Son*) (TM, Pretoria); 1 ♀, Transvaal, Pilgrims Rest, 12.xii.1920 (*Skea*); 3 ♂, 1 ♀, Transvaal, [Kruger National Park,] Satara, 27.iii.1952 (*Janse & Vári*) (TM, Pretoria); 1 ♂, [? Transvaal,] Tweefontein, 31.i.1907 (collector unknown) (TM, Pretoria); 2 ♂, [? Transvaal,] Modderpoort, 18.xii.1924 (*Janse*) (TM, Pretoria); 1 ♂, [? Transvaal,] Buffelspoort, 15.xii.1924 (*Janse*) (TM, Pretoria); 2 ♂, [? Transvaal,] Blauwkop, 30.i.1925 (*Janse*) (TM, Pretoria). **Rhodesia**: 2 ♂, Bulawayo, 15–23.xii.1919 (*Janse*) (TM, Pretoria); 1 ♂, Victoria Falls Road, 61 km ('38 miles') from Bulawayo, 25–26.iv.1954 (*Janse*) (TM, Pretoria); 1 ♂ 6·5 km ('4 miles') NE. of Beit Bridge, 29–30.iii.1954 (*Janse*) (TM, Pretoria). **Mozambique**: 1 ♂, Bela Vista, xi.1916 (*Swierstra*) (TM, Pretoria).

Deltophora diversella **sp. n.**

(Figs 37, 66, 85, 86)

♂, ♀. 5·0–6.5 mm. Head light brown or ochreous, some dark brown scales on margin of eye between base of antenna and proboscis. Labial palpus whitish with brown markings: outer surface of basal segment with dark scales on apex; second segment with dark scales on outer surface near base and dark ring around apical third; third segment with dark apex and broad ring around middle. Antenna dark brown with lighter rings above. Thorax as head, middle darker brown, mesoscutellum with pair of lateral spots and dark apex. Tegula light brown or ochreous, with dark base. Fore wing grey-brown to ochreous, with dark brown markings: some fine markings along proximal half, a dark shadow in third quarter of costa; plical spot at one-fifth, extended to dorsal margin, extension sometimes indistinct; discal spot triangularly extended to dorsal margin; small spot at end of cell, sometimes with shadow to tornus. Apical portion of wing speckled with darker scales.

GENITALIA ♂ (Fig. 66). Uncus hook longer than tegumen, simple, slender. Anterior margin of tegumen with wide emargination. Costal margin of valva with obtuse angle at about one-half; distal half of valva narrow, widest at about three-quarters; distal margin straight, at obtuse angle to costa. Sacculus separated from valva by wide emargination, broad at base, tapered, almost as long as valva; ventral margin straight, setose. Saccus broad, as large as tegumen. Basal half of aedeagus inflated, apical half membranous, supported by narrow lateral sclerotization, with broad ventral projection. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Figs 85, 86). Apophysis posterior nearly 3 times length of apophysis anterior. Middle and posterior part of eighth sternite membranous, with minute spines, anterior part sclerotized, anterior margin strongly convex in middle. Sclerotized fold around ventral margin of ostium bursae with deep median emargination. Posterior part of ductus bursae not dilated to antrum. Colliculum close to ostium bursae. Ductus bursae about 1·5 times length of apophysis posterior, at entrance of corpus bursae about twice as wide as at colliculum. Corpus bursae elongate, anterior two-thirds with minute spines. Signum a sturdy hook, inner surface serrate, base plate elongate, scobinate.

REMARKS. The scales on the head and thorax of the available specimens are more or less rubbed, the above description is therefore incomplete. A ♀ from Uganda is slightly larger (6·0 mm) than the specimens from Kenya; its head shows a dark longitudinal line on vertex and frons.

The ♂ genitalia of *diversella* share with those of *angulella* the long uncus, narrow valva and long tapered sacculus; however, *angulella* differs by the distinct costal hump and truncate apex of the valva and the absence of a ventral projection on the apex of the aedeagus. Externally *diversella* differs from *angulella* by the smaller size and the fore wing markings, particularly the shape of the discal spot. *D. diversella* is externally very similar to *typica* with which its distribution overlaps; determinations based on external characters alone are not always reliable. For differences between *diversella* and *typica* see p. 277.

BIOLOGY. Host-plant unknown. Moths have been collected in January, May, September and October.

DISTRIBUTION. South Africa (N. Transvaal); S. Mozambique; Kenya; Uganda.

MATERIAL EXAMINED.

Holotype ♂, **Kenya**: Kikuyu, Ibea, Escarpment, 2300–2600 m ('7500–8500 feet'), ix–x.1900 (*Doherty*) (genitalia slide no. 14 838; BMNH).

Paratypes. **South Africa**: 1 ♀, N. Transvaal, Wyl[l]ie's Poort, 31.i.1925 (*Janse*) (TM, Pretoria). **Mozambique**: 1 ♀, S. Mozambique, Magude, x.1910 (*Swierstra*) (TM, Pretoria). **Kenya**: 9 ♂, 1 ♀, Kikuyu, Ibea, Escarpment, 2300–2600 m ('7500–8500 feet'), ix–x.1900 (*Doherty*) (BMNH). **Uganda**: 1 ♀, Kampala, 22.v.1934 (*Hargreaves*) (BMNH).

Deltophora angulella sp. n.

(Figs 38, 67)

♂. 7·0 mm. Antenna brown, with lighter rings above. Fore wing grey-brown with dark brown markings: dark shadow on second third of costa; small plical spot at about one-fifth; discal spot extended to dorsal margin, triangular, proximal margin of spot meets dorsal margin of wing at right angles; small spot at end of cell.

GENITALIA ♂ (Fig. 67). Uncus hook longer than tegumen, simple, slender, apex blunt. Anterior margin of tegumen emarginate to one-half. Valva narrow, apical portion slightly dilated, truncate; costa with rounded projection at three-quarters. Sacculus triangular, almost as long as valva. Raised group of setae near place where valva and sacculus separate. Saccus almost as large as tegumen. Aedeagus as long as uncus plus tegumen; basal third inflated, sclerotized; apical two-thirds membranous, supported by narrow, lateral, sclerotized rod; apex slightly curved ventrad.

GENITALIA ♀. Unknown.

REMARKS. The head and thorax of the only specimen are rubbed, some dark scales are visible on the margin of the eyes, between the base of the antenna and the proboscis. The second and third segments of the labial palpi are missing; there are some dark scales on the outer surface of the basal segment.

D. angulella is distinguished from *diversella*, which occurs in the same area, by its larger size, the costal hump and the dilated apex of the valva and the long, membranous, apical portion of the aedeagus which lacks a ventral projection below the apex.

BIOLOGY. Host-plant unknown. The only moth has been collected by Doherty in September–October.

DISTRIBUTION. Kenya.

MATERIAL EXAMINED.
Holotype ♂, **Kenya**: Kikuyu, Ibea, Escarpment, 2300–2600 m ('7500–8500 feet'), ix–x.1900 (*Doherty*) (genitalia slide no. 14 828; BMNH).

Deltophora peltosema (Lower, 1900)

(Figs 15, 39, 68, 87)

Xenolechia peltosema Lower, 1900, *Proc. Linn. Soc. N.S.W.* **25** : 50. Holotype ♀, AUSTRALIA: New South Wales, Broken Hill, 15.x.1898 (*Lower*) (SAM, Adelaide) [not examined].
Aristotelia peltosema (Lower) Meyrick, 1904 : 291.
Aristotelia peltosema (Lower); Meyrick, 1906 : 138.
Gelechia pyramidophora Turner, 1919, *Proc. R. Soc. Qd* **31** : 123. Holotype ♂, AUSTRALIA: Queensland, Adavale, iv.1904 (*Turner*) (genitalia slide no. 615c, Sattler; ANIC, Canberra) [examined]. [Synonymized by Meyrick, 1925 : 47.]
Gelechia pyramidophora Turner; Turner, 1921 : 47.
Aristotelia peltosema (Lower); Meyrick, 1925 : 47 (partim).

♂, ♀. 5·0–5·5 mm. Head ochreous, speckled with brown, particularly on vertex. Labial palpus pale ochreous with brown markings: basal segment brown on outer surface; second segment mostly brown, light at base, before middle and at apex; third segment with dark ring below middle and dark apex. Antenna brown with lighter rings above. Thorax ochreous or light brown, with pair of dark lateral spots and dark apex of mesoscutellum; sometimes anterior part of thorax speckled with dark brown. Tegula ochreous with dark brown base. Fore wing grey-brown to ochreous, with mostly indistinct dark brown markings; costa with some weak markings in basal half and dark shadow in third quarter; plical spot indistinct, extended to dorsal margin; discal spot more distinct, lined with ochreous, extended to dorsal margin; spot at end of cell small or absent; indistinct dark shadow between tornus and end of cell; apical quarter of wing sometimes with darker scales.

GENITALIA ♂ (Figs 15, 68). Uncus hook simple, as long as tegumen. Anterior margin of tegumen evenly concave, without median emargination. Valva distally dilated; costal margin gently curved near base, distal three-quarters straight; distal margin at right angles to costa; distal part of valva extended ventrad to form strong apex. Sacculus separated from valva by deep emargination, subtriangular, ventral margin curved, setose. Saccus rounded, about half size of tegumen. Basal half of aedeagus inflated, sclerotized; apical half narrower, membranous, supported by narrow lateral sclerotization; sharp ventral thorn below apex. Ductus ejaculatorius without sclerotized lamina.

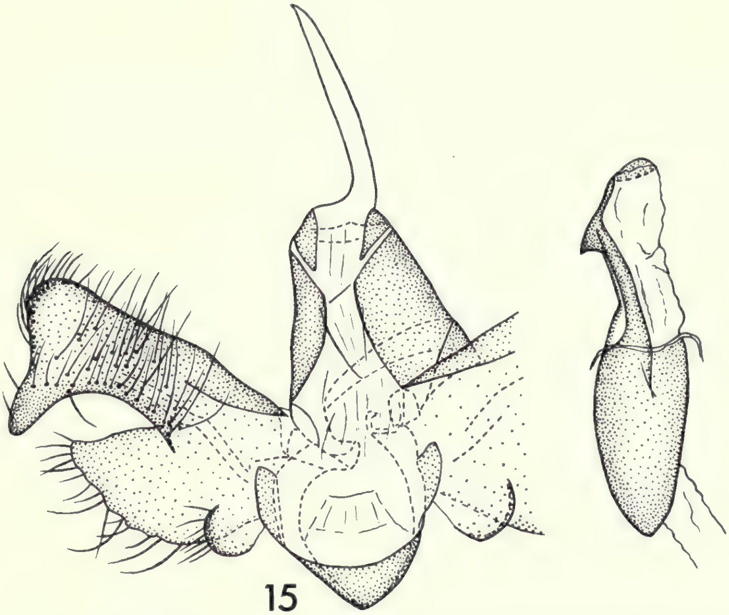


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Fig. 15 *Deltophora peltosema* (Lower), ♂. Genitalia of synonym *Gelechia pyramidophora* Turner, holotype (genitalia slide no. 415d, Sattler; ANIC, Canberra).

GENITALIA ♀ (Fig. 87). Apophysis posterior about twice length of apophysis anterior. Eighth sternite membranous, anterior margin in front of ostium bursae weakly sclerotized, convex. Antrum a broad funnel, ventral margin medially emarginate. Colliculum touches antrum. Ductus bursae twice length of apophysis posterior, at entrance of corpus bursae about twice as wide as at colliculum. Corpus bursae oval, inner surface with minute spines which extend into extreme anterior portion of ductus bursae. Signum near middle of corpus bursae, a strong hook, concave surface of apical half serrate; base plate elongate, scobinate.

REMARKS. *D. peltosema* is externally similar to the African *typica* and *diversella*; however, their ranges of distribution do not overlap. *D. distinctella* from India differs by the more distinct dark markings of the fore wing, particularly the large spot at the end of the cell. The ♂ genitalia of *peltosema* resemble those of *typica*, *distinctella* and *fasciella* but differ by the distinct ventral spine on the apex of the aedeagus (for further differences see *typica*, p. 277). The ♀ genitalia differ from those of the above species by the wide ostium bursae and the median emargination of its ventral margin.

X. peltosema Lower was described from a single ♀. The holotype is partly damaged and has lost its head and abdomen. A photograph of the holotype, received together with additional information on the specimen from Mr A. N. MacFarland of the South Australian Museum, has satisfied me that this species is correctly identified.

BIOLOGY. Host-plant unknown. Meyrick's suggestion that *peltosema* might have been dispersed by man with some cultivated plant was based on the erroneous assumption that it is a widely distributed species (Australia, India, Africa, South America) (Meyrick, 1908 : 724; 1931 : 278). Moths have been collected in September–April.

DISTRIBUTION. India; Ceylon; Australia (Western Australia, Queensland, New South Wales).

Several authors have erroneously recorded *peltosema* from South Africa and South America. Re-examination of the material concerned has revealed the following misidentifications: South Africa (Meyrick, 1908 : 724; 1925 : 47; Janse, 1917 : 178; 1950 : 122; Gaede, 1937 : 69) – *typica* sp. n.; South America (Meyrick, 1925 : 47; 1931 : 278; Gaede, 1937 : 69) – *lanceella* sp. n., *minuta* sp. n., *suffusella* sp. n.

MATERIAL EXAMINED.

India: 1 ♂, Hoshangabad, 17.ii.1912 (*Fletcher*) (BMNH); 1 ♂, Bihar, Pusa, 27.iv.1929 (*Sontakay*) (BMNH); 1 ♀, Kanara, Dharwar, 13.iii.1916 (*Maxwell*) (BMNH). **Ceylon**: 1 ♂, 1 ♀, Puttalam, 189[?] (*Pole*) (BMNH); 3 ♂, 2 ♀, Puttalam, ix, x, xii.1904 (*Pole*) (BMNH); 1 ♀, Weligama, 16.i.1908 (*Fletcher*) (BMNH). **Australia**: 1 ♂, 1 ♀, Western Australia, Geraldton, 8, 11.xi.1886 (*Meyrick*) (BMNH); 1 ♂, N. Queensland, Townsville, 25.vi.1900 (*Dodd*) (BMNH).

Deltophora distinctella sp. n.

(Figs 40, 69, 88, 89)

♂, ♀. 5·5–6·5 mm. Head light brown or ochreous, speckled with darker brown. Labial palpus whitish, with brown markings: outer surface of basal segment brown; second segment with broad rings at base and behind middle; third segment with ring before middle and dark apex. Antenna dark brown with paler rings above. Thorax as head, mesoscutellum with pair of lateral spots and dark apex. Tegula ochreous or light brown, with dark base. Fore wing light grey-brown with distinct dark brown markings: costa with dark markings at base, one-quarter, one-third and dark shadow in distal half, interrupted by whitish mark at three-quarters; plical spot at one-quarter, extended to dorsal margin, sometimes small spot on fold separate; discal spot extended to dorsal margin, widest at fold; spot at end of cell extended to tornus.

GENITALIA ♂ (Fig. 69). Uncus hook simple, as long as tegumen. Anterior margin of tegumen medially with deep emargination which nearly reaches base of uncus. Emargination constricted near middle of tegumen, posterior part expanded, round. Valva distally dilated; costal margin straight; distal margin straight, at acute angle to costa; distal part of valva extended ventrad to form broad, triangular apex. Sacculus separated from valva by deep emargination, broad, apex rounded, ventral margin straight, setose. Saccus rounded, about three-quarters size of tegumen. Basal half of aedeagus inflated, sclerotized; apical half slightly narrower, membranous, supported by narrow lateral sclerotization; big blunt ventral thorn below apex. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Figs 88, 89). Apophysis posterior twice length of apophysis anterior. Eighth sternite membranous, with minute spines which extend into antrum. Sclerotized ventral branch of apophysis anterior extends along anterior margin of eighth sternite. Antrum a wide pouch with gently curved ventral margin, laterally supported by ventral branch of apophysis anterior, anterior margin convex. Colliculum touches antrum. Ductus bursae about length of apophysis posterior, at entrance of corpus bursae about twice as wide as at colliculum. Corpus bursae oval, inner surface with minute spines. Signum a strong hook, concave surface of apical half serrate, base plate elongate, scobinate.

REMARKS. *D. distinctella* differs from *peltosema* by the distinct dark markings of the fore wing, particularly the large spot between the tornus and the end of the cell. In the ♂ genitalia *distinctella* differs from *peltosema* by the deep emargination of the anterior margin of the tegumen, the much broader distal portion of the valva, the rounded sacculus and the stronger ventral thorn below the apex of the aedeagus. The ♀ genitalia of *distinctella* differ from those of *peltosema* by the larger antrum and the ventral margin of the ostium bursae which lacks the distinct median emargination. For differences between *distinctella* and *typica* see p. 277.

The holotype specimen of *distinctella* was sent by the collector, the late Sir Reginald M. Maxwell, to Meyrick who labelled it 'Dharwar, Kanara'. However, a second specimen collected on the same day is labelled 'Hebsur', and this agrees with the dates and localities in an itinerary which was very kindly made available to me by Lady L. Maxwell.

BIOLOGY. Host-plant unknown. Moths have been collected in January–March and September–November.

DISTRIBUTION. India.

MATERIAL EXAMINED.
Holotype ♂, **India**: Dharwar, Hebsur [15°28′ N, 75°18′ E], 28.i.1916 (*Maxwell*) (genitalia slide no. 14 856; BMNH).

Paratypes. **India**: 2 ♂, 1 ♀, Bombay, Bassein Fort, x.1909 (*A.M.*) (BMNH); 1 ♀, East Khandesh, Chopda, 27.xi.1917 (*Maxwell*) (BMNH); 1 ♀, [Central Prov.,] Nagpur, 10.ix.1931 (*Dult*) (BMNH); 1 ♀, Dharwar, Hebsur, 28.i.1916 (*Maxwell*) (BMNH); 1 ♀, Dharwar, Kolivad, 6.ii.1916 (*Maxwell*) (BMNH); 1 ♂, S. India, [Madras,] Coimbatore, 5.iii.1913 (*Fletcher*) (BMNH).

Deltophora fasciella **sp. n.**

(Figs 41, 42, 70, 90)

[*Teleia maculata* Staudinger; Amsel, 1935 : 263 (partim). Misidentification.]
[*Teleia maculata* Staudinger; Amsel, 1961 : 59 (partim). Misidentification.]

♂, ♀. 5·0–6·5 mm. Head pale whitish brown, speckled with darker brown. Labial palpus whitish with brown markings: outer surface of basal segment dark; outer surface of second segment with dark scales near base and before apex; third segment with narrow ring around middle and some dark scales on apex. Antenna dark brown with lighter rings above. Thorax as head, speckled to varying degree with darker brown, with pair of dark lateral spots and dark apex of mesoscutellum. Tegula whitish brown with dark base. Fore wing pale whitish brown with dark markings: several fine spots on costa; discal spot extended to costa and dorsal margin to form distinct transverse band; small spot at end of cell; some darker scales in apical portion of wing.

GENITALIA ♂ (Fig. 70). Uncus hook simple, shorter than tegumen. Anterior margin of tegumen with wide emargination. Valva distally dilated; costal margin straight or very gently curved; distal margin convex; distal part of valva extended ventrad to form strong beak-like apex. Sacculus separated from valva by deep emargination, broad, rounded, margin setose. Saccus rounded, about half size of tegumen. Basal three-quarters of aedeagus inflated, sclerotized; apical quarter membranous, supported by narrow lateral sclerotization; strong ventral thorn below apex. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Fig. 90). Apophysis posterior 1·5 times length of apophysis anterior. Eighth sternite membranous, with gently curved sclerotized band along anterior margin. Antrum a very short membranous funnel. Colliculum touches antrum. Ductus bursae about 3 times length of apophysis posterior, at entrance of corpus bursae about 3 times as wide as at colliculum. Corpus bursae spherical, inner surface with minute spines which extend short distance into extreme anterior portion of ductus bursae. Signum a strong hook, concave surface serrate, base plate elongate, scobinate.

REMARKS. The ground colour of the fore wing is variable; in two ♀ from Israel (Fig. 42) and Afghanistan it is almost white. In the ♂ genitalia the anterior emargination of the tegumen is variable; it is broad, angular or somewhat tapered, and reaches the middle or the anterior third of the tegumen.

D. fasciella is externally similar to *maculata*, with which it has been confused and which may occur in the same area. It differs from *maculata* by the complete transverse fascia of the fore wing. The ♂ genitalia resemble those of *typica*, *peltosema* and *distinctella* but differ by the short apical portion of the aedeagus with a strong ventral thorn. The ♀ genitalia are closest to those of *typica*; they differ by the membranous antrum (sclerotized in *typica*) and the stronger signum which is situated in the posterior part of the corpus bursae (anterior part in *typica*). For further differences see *typica*, p. 277.

A single ♂ from the Sudan agrees with *fasciella* in the genitalia; however, the discal spot of the fore wing is not extended to the costal margin. This specimen is excluded from the type-series of *fasciella*.

I was unable to trace the exact location of Shaib Ghurban, the locality of the holotype; however, several other localities in which Philby collected at the same time are situated in south-western Saudi Arabia (Najrān oasis–Wadi Habawnāh area) on the border of Yemen (Scott, 1957).

BIOLOGY. Host-plant unknown. Moths have been collected in April, May and November.

DISTRIBUTION. [? Sudan (Kassala Prov.)]; Israel (Jordan west bank territories); S.W. Saudi Arabia; S. Iran (Luristan); E. Afghanistan.

MATERIAL EXAMINED.
Holotype ♂, **Saudi Arabia**: [Najrān oasis–Wadi Habawnāh area] Shaib Ghurban, 15.xi.1936 (*Philby*) (genitalia slide no. 14 830; BMNH).

Paratypes. **Israel**: 1 ♀, [Jordan west bank territories,] Wadi el Kelt, Georgskloster, 15.iv.1930 (*Amsel*) (LN, Karlsruhe). **Iran**: 3 ♂, 2 ♀, S. Iran, [Luristan,] Abad-Geno, 40 km N. of Bandar-Abbas, 27.iv, 6.v.1974 (*Exped. Mus. Vindob.*) (NM, Vienna; BMNH); 1 ♂, S. Iran, [Luristan,] 22 km N. of Bandar-Abbas, 22.iv.1974 (*Exped. Mus. Vindob.*) (NM, Vienna). **Afghanistan**: 1 ♀, E. Afghanistan, Sarobi, 1100 m, 9.vi.1957 (*Wegner*) (LN, Karlsruhe).

Material excluded from the type-series. **Sudan**: 1 ♂, Kassala Prov., Erkowit, 1000–1300 m, 20.iv.1962 (*Remane*) (BMNH).

The *maculata*-group

GENITALIA ♂. Uncus strongly dilated. Sacculus separated from valva, pointed or digitate. Sclerotized juxta present. Ductus ejaculatorius with sclerotized lamina.

GENITALIA ♀. Posterior margin of seventh segment with pair of pleural pits. Ventral margin of ostium bursae posteriorly convex or concave. Antrum sclerotized or membranous. Inner surface of corpus bursae without spines. Signum reduced: sclerotized plate with one or two longitudinal serrated crests.

DISTRIBUTION. S.E. Europe; W. Asia; India.

Deltophora maculata (Staudinger, 1879) comb. n.

(Figs 1, 2, 5, 6, 16–27, 43, 44, 60, 63, 71, 91–94)

Teleia maculata Staudinger, 1879, *Horae Soc. ent. ross.* **15** : 314. LECTOTYPE ♀, TURKEY: Amasya, Kerasdere, vii–viii.1875 (*Staudinger*) (genitalia slide no. 617b, Sattler; MNHU, Berlin), here designated [examined].
Teleia maculata Staudinger; Seebold, 1898 : 30.
Gelechia (*Teleia*) *maculata* (Staudinger) Rebel, 1901 : 151.
[? Genus] *maculata* (Staudinger) Spuler, 1910 : 359.
Teleia maculata Staudinger; Rebel, 1915 : (54).
Teleia maculata Staudinger; Caradja, 1920 : 105 (partim).
Aristotelia maculata (Staudinger) Meyrick, 1925 : 47.
Teleia maculata Staudinger; Rebel, 1929 : 204.
Teleia maculata Staudinger; Amsel, 1933 : 125.
Teleia maculata Staudinger; Amsel, 1935 : 263 (partim).
Aristotelia maculata (Staudinger); Gaede, 1937 : 64.
Teleia maculata Staudinger; Amsel, 1953 : 415.
Teleia maculata Staudinger; Kuznetzov, 1960 : 34.

♂, ♀. 5·0–7.0 mm. Head whitish grey to grey-brown, vertex speckled with brown. Labial palpus as head; outer surface of basal segment brown; outer surface of second segment with dark scales near base and apex; third segment with dark apex and ring below middle. Antenna dark brown with lighter rings above. Thorax as head, speckled with darker brown, with lateral pair of dark spots and dark apex of mesoscutellum. Tegula as head and thorax, with dark base. Fore wing whitish grey to grey-brown, with dark brown markings: small spots on costa at base, one-fifth and three-fifths, sometimes several small spots in between, in second and third fifth of costa; plical spot at one-fifth; discal spot extended to dorsal margin, sometimes nearly reaching costa as well; spot at end of cell often extended to tornus. Apical portion of wing darker than basal four-fifths, sometimes completely dark brown (Fig. 43). Dark fore wing markings sometimes lined with ochreous scales.

GENITALIA ♂ (Figs 16–26, 71). Length of individual scales of posterior pair of coremata about 8 times their greatest width. Uncus medially strongly dilated, about as long as tegumen. Anterior margin of tegumen with wide triangular or arcuate emargination. Costal margin of valva curved, sometimes with small process on distal part. Apex of valva rounded. Sacculus much shorter than valva, apex with strong point. Juxta large, subtriangular, strongly sclerotized. Saccus as large as tegumen. Basal half of aedeagus inflated, sclerotized; apical half membranous, supported by narrow ventro-lateral sclerotization which bears strong thorn near middle of aedeagus. Ductus ejaculatorius with large sclerotized lamina of about half length of aedeagus.

GENITALIA ♀ (Figs 27, 91–94). Posterior margin of seventh abdominal segment with pair of strongly sclerotized pleural pits (Fig. 63). Membranous intersegmental region between eighth segment and papillae anales with deep ventral invagination (Figs 91–94). Apophysis posterior about twice length of apophysis anterior. Ostium bursae in or slightly behind middle of eighth sternite. Ventral margin of ostium with subtriangular posterior extension. Anterior margin of eighth sternite weakly concave. No sclerotized antrum. Colliculum close to ostium bursae. Length and size of ductus and corpus bursae variable. Corpus bursae without spines. Signum variable, typically an irregularly shaped sclerotized plate, scobinate, with serrated longitudinal ridge.

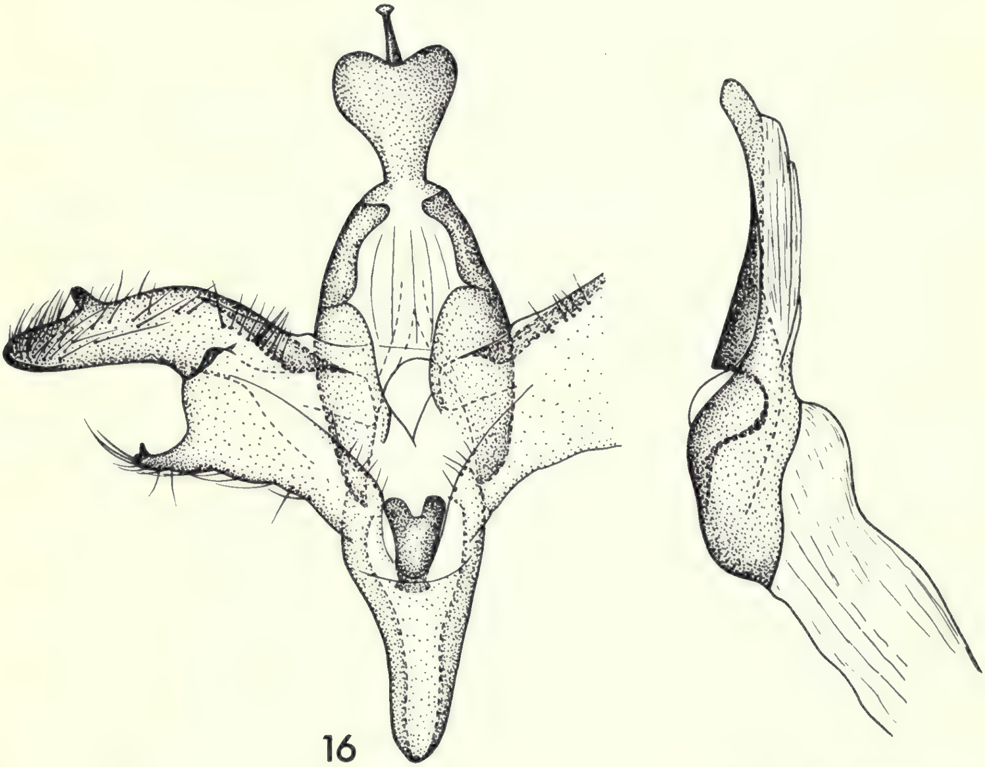
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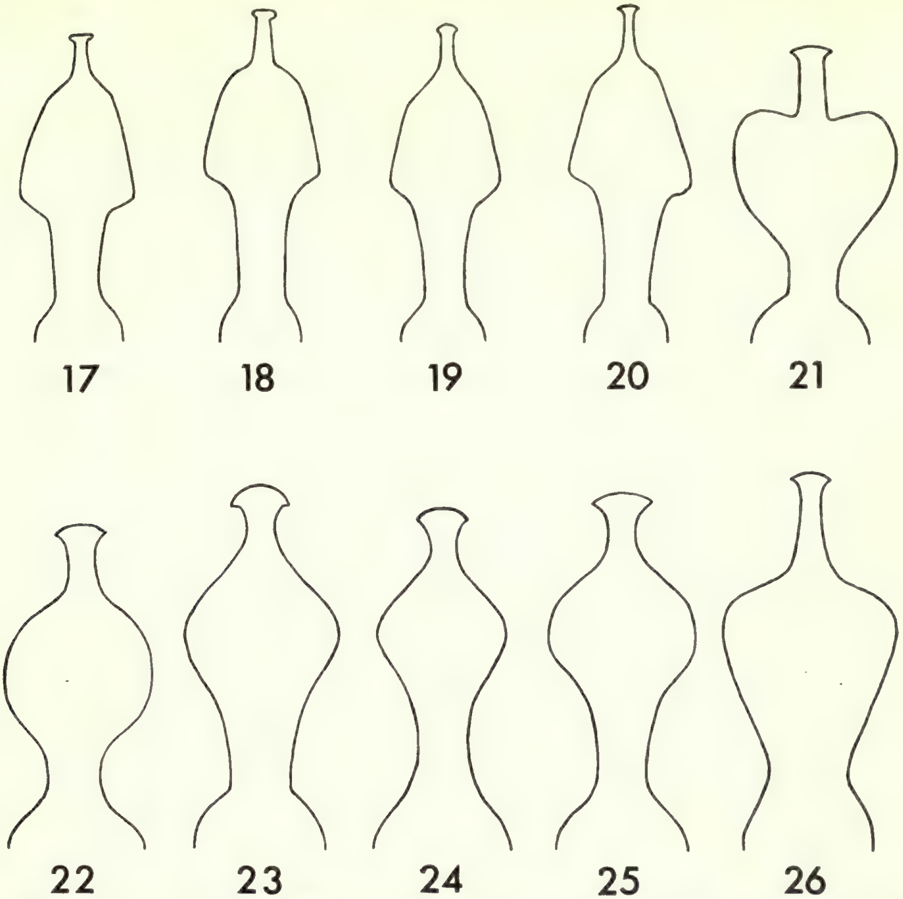
Fig. 16 *Deltophora maculata* (Staudinger), ♂ genitalia. Turkey, Anatolia (slide no. 400; ZSBS, Munich).

REMARKS. *D. maculata* exhibits considerable individual and geographic variation, externally and in the genitalia. The second segment of the labial palpus varies from almost completely dark with only a light ring at the apex and a few light patches on the inner surface to light with a few dark scales at the base and apex. On the fore wing the apex can be dark brown or as light as the rest of the wing; the shape and size of the dark markings are also variable. In the ♂ genitalia the shape of uncus, valva and juxta and the length of the apex of the sacculus vary. As an example the uncus shapes of several specimens are illustrated (Figs 17–26). In specimens from northern Turkey (Pontus) and the Lebanon the dilated posterior portion of the uncus resembles an arrowhead; in specimens from northern Syria and central Anatolia (Akşehir) it is heart-shaped and in specimens from Georgia and Afghanistan rounded or ovoid. In a specimen from the Lebanon (Fig. 26), which was collected together with the specimen illustrated in Fig. 19, it approaches the shape of the uncus of Syrian specimens. In the ♀ the eighth sternite is sclerotized to a varying



Figs 17–26 *Deltophora maculata* (Staudinger), ♂ genitalia. Outlines of uncus. 17, Turkey, Pontus (slide no. 15 423; BMNH). 18, Turkey, Pontus (slide no. 15 421; BMNH). 19, Lebanon (slide no. 16 392; BMNH). 20, Lebanon (slide no. 15 406; BMNH). 21, Syria (slide no. 14 832; BMNH). 22, U.S.S.R., Georgia (slide no. 15 434; BMNH). 23, Afghanistan (slide no. 15 411; BMNH). 24, Afghanistan (slide no. 14 783; BMNH). 25, Afghanistan (slide no. 3471; NM, Vienna). 26, Lebanon (slide no. 6470, Jäckh; coll. Jäckh, Bidingen).

degree and the subtriangular sclerotization on the ventral margin of the ostium bursae varies in size and shape. The signum is usually reduced and bears one or two serrated ridges; the anterior end of the stronger ridge is sometimes developed into a robust spine. Length and size of ductus and corpus bursae are also variable. There is usually a clear division into ductus and corpus; however, the former is sometimes strongly dilated from the colliculum so that no distinction of the two parts is possible.

D. maculata is externally similar to *fasciella*; it differs by the discal spot which never reaches the costal margin of the fore wing. *D. beatrix* which belongs to the same species-group differs externally by the cream colour and the broad transverse band of the fore wing. In the ♂ genitalia the uncus of *maculata* is narrow at the base and distally dilated, whereas in *beatrix* it is widest near the base and gently tapered towards the apex; *beatrix* also differs by the distally dilated valva and the long digitate process of the sacculus. In the ♀ genitalia *maculata* differs from all other species by the subtriangular posterior plate on the ventral margin of the ostium bursae.

Spuler (1910 : 359) noticed the presence of ocelli and therefore excluded *maculata* from *Teleia* without, however, assigning it to another genus. Meyrick (1925 : 47) transferred *maculata* to

Aristotelia which was a more logical place for it. Meyrick (l.c.) placed *korbi* Caradja as a possible synonym of *maculata*; this is incorrect, as *korbi* is a separate species.

The date of publication was erroneously cited as 1880 by several authors. The correct date (1879, November 1st) was taken from 'Repartition des livraisons', issued with the 'Tables des matières' of *Horae Soc. ent. ross.* **15**.

D. maculata was described from an unspecified number of specimens collected by Staudinger at light near Amasya from the beginning of July to the beginning of August, 1875. In coll. Staudinger (MNHU, Berlin) there are 1 ♂, 3 ♀, bearing Staudinger's pink printed label 'Origin.'.

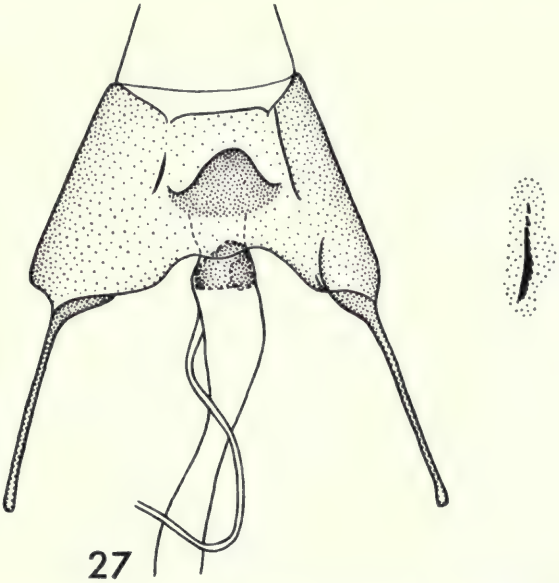


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Fig. 27 *Deltophora maculata* (Staudinger), ♀ genitalia. Turkey, Pontus (slide no. 12 549; BMNH).

The first specimen in the series, a ♀ with the locality label 'Amasia m[ihi].', is here designated as the lectotype. The other three specimens, now labelled as paralectotypes, bear no locality labels; however, two of them bear small labels with their date of capture. For detailed information on the type-locality 'Kerasdere' [=valley of the cherries] see Staudinger (1878 : 206).

Some information, including ecological data, on the collecting sites of Amsel (Afghanistan, 1956) and Kasy and Vartian (Syria and Lebanon, 1961; Iran and Afghanistan, 1963) was published by Amsel (1957) and Kasy (1964; 1965) respectively.

I was unable to trace 'Shar Deresy' which must be somewhere north or south of the present Turkish–Syrian border. Material from this locality was obtained in the 1890s by a native collector for J. H. Leech through whom it reached Lord Walsingham and finally the BMNH. Specimens in the BMNH collection are labelled 'Syria, Haleb, Shar Devesy'. 'Devesy' is an error for 'Deresy' and probably originated from someone misreading a handwritten label. The old Ottoman province of Haleb comprised parts of Syria and Turkey. In Walsingham's notebook on the Leech collection 'Syria' was subsequently replaced by 'Asiatic Turkey'; however, it is unknown by whom and on what evidence.

Material examined from the Jordan west bank territories is recorded under Israel.

BIOLOGY. Host-plant unknown. Moths have been collected in April–September and November. According to Kuznetzov (1960 : 34) *maculata* is common in the arid higher altitudes of the western Kopet Dag, where it occurs in one generation from May till August.

DISTRIBUTION. U.S.S.R. (Georgia; Armeniya; Azerbaydzhan); Turkey; Syria; Lebanon; Israel (including Jordan west bank territories); Iran; Afghanistan. According to the literature also found in Greece (Parnassos) (Rebel, 1915 : 54) and U.S.S.R. (Turkmeniya) (Kuznetzov, 1960 : 34); according to Klimesch (personal communication) in Crete.

Several authors have erroneously recorded *maculata* from S. France, Israel and S.W. Arabia. Re-examination of the material concerned has revealed the following misidentifications: S. France (Caradja, 1920 : 105; Gaede, 1937 : 64; Lhomme, [1946] : 561; Amsel, 1961 : 59) – *stictella*; Israel (Amsel, 1935 : 263, partim), S.W. Arabia (Amsel, 1961 : 59) – *fasciella*.

MATERIAL EXAMINED.

U.S.S.R.: 1 ♂, Georgia, Borshom, [near Tbilisi,] 2.vi.1880 (*Christoph*) (BMNH); 1 ♂, 3 ♀, Armeniya (collectors unknown) (BMNH; MNHN, Paris; MINGA, Bucharest); 1 ♂, Azerbaydzhan, Lenkoran, 20.vi.1884 (*Christoph*) (BMNH). **Turkey**: 4 ♂, Anatolia, Kizilcahamam, 700 m, 31.vii–1.viii.1963 (*Arenberger*) (coll. Arenberger, Vienna); 5 ♂, 5 ♀, Pontus (*Staudinger*) (BMNH); 1 ♂, 2 ♀, Amasya, 22.vii, 2.viii.1875 (*Staudinger*) (MNHU, Berlin) (paralectotypes); 2 ♂, 2 ♀, Amasya (collectors unknown) (BMNH; MINGA, Bucharest); 1 ♂, 5 km N.W. of Gümüşane, 1050 m, 12.vi.1969 (*Arenberger*) (coll. Arenberger, Vienna); 1 ♂, 1 ♀, Central Anatolia, Akşehir, 1200 m, 16–30.ix.1934 (*Osthelder*) (ZSBS, Munich); 2 ♂, Akşehir (collector unknown) (MINGA, Bucharest); 1 ♂, Dim Çay valley, 500 m, 14.ix.1968 (collector unknown) (coll. Burmann, Innsbruck); 1 ♀, Taurus, 1906 (*J.*) (BMNH); 1 ♀, Maraş (collector unknown) (MINGA, Bucharest); 1 ♂, 1 ♀, Central Taurus, Maraş, 600–900, 1200 m, 19.v.1928, v.1930 (native collector) (ZSBS, Munich); 1 ♀, Northern Amanus mts, Yüksek Dağ, Jeşil dere, vii.1932 (native collector) (ZSBS, Munich). **Syria**: 2 ♂, 4 ♀, Haleb, Shar Deresy ('Shar Devesy'), 1893 (native collector) (BMNH); 1 ♀, 60 km N.E. of Latakia, 6–7.vi.1961 (*Kasy & Vartian*) (NM, Vienna). **Lebanon**: 1 ♀, 15 km E. of Batroun, 12.v.1961 (*Kasy & Vartian*) (NM, Vienna); 1 ♀, Beirut (collector unknown) (MINGA, Bucharest); 3 ♂, 3 ♀, 25 km N. of Beirut, 11.v.1961, 12.v.1963 (*Kasy & Vartian*) (BMNH; NM, Vienna; coll. Glaser, Vienna; coll. Jäckh, Bidingen); 2 ♂, 1 ♀, E. of Saida, 9–16.v.1963 (*Kasy & Vartian*) (NM, Vienna) [first record for Lebanon]. **Israel**: 1 ♂, Tel-Aviv, 26–27.xi.1925 (*Bodenheimer*) (NM, Vienna); 1 ♀, Jerusalem (collector unknown) (MINGA, Bucharest); 1 ♂, Ain Karim, 10 km W. of Jerusalem, 1.vi.1930 (*Amsel*) (LN, Karlsruhe); 1 ♂, Jerusalem, Ramallah, 21.iv.1930 (*Amsel*) (LN, Karlsruhe). **Iran**: 1 ♀, Prov. Tehran, Ab-Ali, 2550 m ('8250 feet'), 25.vi.1973 (*Cottrill & Tremewan*) (BMNH); 1 ♀, Vanak, 15 km N. of Tehran, 1600 m, 1–10.vii.1962 (*Vartian*) (NM, Vienna); 2 ♀, Derbend, 25 km N. of Tehran, 2000 m, 28–30.v, 7–15.vi.1963 (*Kasy & Vartian*) (BMNH; NM, Vienna); 1 ♀, N.E. Iran, 20 km E. of Sabzevar, 20.vi.1963 (*Kasy & Vartian*) (NM, Vienna); 1 ♀, N.E. Iran, W. of Mashad, 21.vi.1963 (*Kasy & Vartian*) (NM, Vienna) [first record for Iran]. **Afghanistan**: 3 ♂, 4 ♀, N. Afghanistan, Herat, 970 m, 5.v.1956 (*Amsel*) (LN, Karlsruhe); 15 ♂, 31 ♀, N. Afghanistan, Pul-i-Khumri ('Polichomri'), 700 m, 5.vi.1956 (*Amsel*) (BMNH; LN, Karlsruhe); 6 ♂, 1 ♀, Khurd-Kabul, S.E. of Kabul, 1900 m, 5.vii.1963, 20.v–5.vii.1965 (*Kasy & Vartian*) (NM, Vienna); 1 ♂, 1 ♀, 10 km N.W. of Kabul, 1900 m, 1, 25.vi.1965 (*Kasy & Vartian*) (NM, Vienna); 2 ♂, 2 ♀, Nuristan, Bashgul valley, 1100–1200 m, 6–19.v.1953 (*Klapperich*) (LN, Karlsruhe) [first record for Afghanistan].

Deltophora beatrix **sp. n.**

(Figs 45, 72)

♂. 6·0 mm. Head cream. Labial palpus as head, outer surface of first segment brown; third segment with some scattered brown scales. Antenna light, with dark brown rings above. Thorax slightly darker than head, mesoscutellum laterally with pair of dark spots. Tegula as thorax, base dark brown. Fore wing cream, with black markings: costa with dark base and small spot at one-quarter, small spot on base of dorsal margin, broad band across middle of wing, narrow band across third quarter of wing connected along termen with dark apex.

GENITALIA ♂ (Fig. 72). Length of individual scales of posterior pair of coremata about 5 times their greatest width. Uncus about as long as tegumen, base inserted on dorsal surface of latter; distal portion of uncus long, arising on dorsal surface of basal portion, forming dorsally open trough; basal portion short, narrowing posteriorly; distal portion evenly dilated from base, widest at basal quarter, tapering posteriorly; apex broad, convex. Posterior margin of tegumen truncate, slightly concave, anterior margin with triangular emargination. Valva distally dilated, narrowest near middle, widest at four-fifths; costal margin gently curved, distal margin strongly convex. Sacculus three-quarters length of valva, with long digitate process; ventral margin set with long setae. Juxta small, strongly sclerotized, posteriorly with V-shaped emargination. Saccus as long as tegumen but much narrower. Base of aedeagus slightly inflated, sclerotized; apical portion longer than base, supported by narrow ventral sclerotization, with strong thorn near base. Ductus ejaculatorius with large sclerotized lamina of nearly half length of aedeagus.

GENITALIA ♀. Unknown.

REMARKS. *D. beatrix* differs from all other *Deltophora* species by the wing colour and the wide band across the middle of the fore wing. The ♂ genitalia do not resemble closely those of other species; the differences between *beatrix* and *maculata* are discussed on p. 285.

BIOLOGY. Host-plant unknown. Moths have been collected in early May.

DISTRIBUTION. S. Iran (Luristan).

MATERIAL EXAMINED.
Holotype ♂, **Iran**: S. Iran, [Luristan,] Abad-Geno, 40 km N. of Bandar-Abbas, 6.v.1974 (*Exped. Mus. Vind.*) (NM, Vienna).
Paratype. 1 ♂, same data as holotype (NM, Vienna).

Deltophora pauperella sp. n.

(Figs 46, 95)

♀. 6·5 mm. Labial palpus whitish, outer surface of second segment with some scattered brown scales; third segment without dark scales. Antenna dark brown, with lighter rings above. Thorax light ochreous, speckled with brown. Tegula light ochreous, with dark brown base. Fore wing light ochreous, with dark brown markings: plical spot at one-fifth, oblique, extended across fold but not reaching dorsal margin; discal spot extended to dorsal margin; small spot at end of cell. Apical portion of wing speckled with brown.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 95). Posterior margin of seventh abdominal segment with lateral pair of sclerotized pits. Apophysis posterior 3 times length of apophysis anterior, with distinct node at posterior third. Eighth segment nearly twice length of apophysis anterior. Ostium bursae at anterior third of eighth sternite. Ventral portion of antrum strongly sclerotized, anterior margin triangularly extended. Colliculum narrow, very close to antrum. Bursa copulatrix not clearly differentiated into ductus and corpus bursae, ductus bursae gradually and evenly widened into corpus bursae. Signum an almost circular plate with somewhat irregular margin; strong ridge on anterior two-thirds extended into corpus bursae.

REMARKS. The only specimen is rubbed; the head is almost completely denuded. In fresh specimens the ground-colour of head, thorax and fore wings is probably much darker.

D. pauperella is closest to *maculata* and shares with it the sclerotized pleural pits on the posterior margin of the seventh abdominal segment. It differs in the ♀ genitalia by the much longer apophyses posteriores and the absence of a subtriangular extension on the ventral margin of the ostium bursae.

BIOLOGY. Unknown.

DISTRIBUTION. India (Punjab).

MATERIAL EXAMINED.
Holotype ♀, **India**: Punjab, Dharmsala (*Hocking*) (genitalia slide no. 14 825; BMNH).

The *stictella*-group

GENITALIA ♂. Uncus hook simple. Valva distally dilated, with short process. Sacculus short, rounded, not separated from valva. Sclerotized juxta present. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀. Posterior margin of seventh segment without pleural pits. Ventral margin of ostium bursae posteriorly convex. Antrum with subtriangular sclerotization. Inner surface of corpus bursae without spines. Signum a big invagination at entrance of corpus bursae.

DISTRIBUTION. Spain; S. France; N.W. Italy.

Deltophora stictella (Rebel, 1927) **comb. n.**

(Figs 8–11, 28, 29, 47, 48, 73, 96, 97)

Teleia stictella Rebel, 1927, *Z. öst. EntVer.* **12** : 118. LECTOTYPE ♂, SPAIN: Andalucía, Prov. Granada, Sierra de Alfacar, vii.1926 (*Bubacek*) (NM, Vienna), here designated [examined].
[*Teleia maculata* Staudinger; Caradja, 1920 : 105 (partim). Misidentification.]
[*Aristotelia maculata* (Staudinger); Gaede, 1937 : 64 (partim). Misidentification.]
Telphusa stictella (Rebel) Gaede, 1937 : 138.
[*Aristotelia maculata* (Staudinger); Lhomme, [1946] : 561. Misidentification.]
[*Teleia maculata* Staudinger; Amsel, 1961 : 59 (partim). Misidentification.]
Teleiodes stictella (Rebel) Agenjo, 1968 : [3].

♂, ♀. 6·0–7·5 mm. Head, base of proboscis, maxillary palpus and labial palpus ochreous. Vertex sometimes with broad, longitudinal, grey-brown band. Labial palpus with scattered brown scales on outer surface of first and second segment; third segment with scattered brown scales in apical half but without ring around middle. Antenna dark brown, with lighter rings above. Thorax grey with pair of indistinct dark spots on lateral margin of mesoscutellum. Tegula with dark base and lighter apex. Fore wing grey or grey-brown, apical portion beyond end of cell sometimes darker than basal two-thirds of wing. Wing markings dark brown or black, delicately lined with ochreous or light brown scales. Basal fascia incomplete; dark spot on costa, bigger spot in fold and small spot on dorsal margin; discal spot sometimes extended to dorsal margin; distinct spot at end of cell. Usually large light spot on costa at three-quarters and weaker spot on tornus, sometimes connected by indistinct light transverse line. Base of fringes with series of light dots from costa to tornus.

GENITALIA ♂ (Figs 28, 73). Uncus hook simple, shorter than or about as long as tegumen. Anterior margin of tegumen arcuate, without deep median emargination. Valva distally dilated, narrowest near middle; costal margin curved, concave; distal margin convex, with short apical process. Sacculus not separated from valva, short, margin rounded, setose. Sclerotized juxta present. Saccus smaller than tegumen. Basal half of aedeagus strongly inflated, sclerotized; dorsal portion of apical half membranous, ventral portion sclerotized, with strong thorn directed towards base of aedeagus. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Figs 29, 96, 97). Apophysis posterior about 2·5 times length of apophysis anterior. Middle and posterior part of eighth sternite membranous, with minute spines; anterior part sclerotized, anterior margin convex. Ostium bursae at anterior third of eighth sternite, ventral margin slightly extended posteriorly, convex. Ventral wall of antrum with triangular sclerotization. Colliculum near antrum. Ductus bursae about 3 times length of apophysis posterior, at entrance of corpus bursae 3 times as wide as at colliculum. Corpus bursae oval, without spines. Big signum at entrance of corpus bursae, scobinate, composed of two deep folds, which extend into corpus bursae, and narrow tongue which extends into anterior portion of ductus bursae.

REMARKS. The fore wing colour of *stictella* varies from very light to dark grey, the wing markings, particularly the discal spot, vary in size. In a ♀ from southern Spain, collected together with a series of normal specimens, the discal spot and that at the end of the cell are enlarged and fused (Fig. 48).

D. stictella has in the past been confused with *maculata*; however, in *stictella* the ochreous head contrasts more with the grey fore wing than in the overall brown *maculata*. In the fore wing the dark spot at the end of the cell is well defined in *stictella* whereas in *maculata* it is frequently extended to the tornus. The third segment of the labial palpus bears in *maculata* a sometimes incomplete dark brown ring around the middle; in *stictella* it lacks such a ring. The ♂ genitalia of *stictella* differ from those of *maculata* by the simple uncus, distally dilated valva, poorly developed sacculus (which lacks an apical point), shorter and wider saccus and plumper aedeagus (which resembles more that of the North American *glandiferella*). In the ♀ genitalia *stictella* differs from *maculata* by the ventral margin of the ostium bursae which is posteriorly convex but lacks the subtriangular extension; *stictella* is also distinguished by the large specialized signum. The distribution areas of *stictella* and *maculata* do not appear to overlap.

D. stictella was described from 1 ♂, 3 ♀, collected by Bubacek and Reisser at the beginning of July, 1926, in the Sierra de Alfacar near Granada (Spain). The ♂ is here designated as the lectotype.

BIOLOGY. Host-plant unknown. The moths are readily attracted to light and have been collected from the last third of June till the middle of August, at altitudes between 700 m and 2000 m. There appears to be only one generation a year.

DISTRIBUTION. Spain (Cataluña, Andalucía); S. France (Basses-Alpes, Alpes-Maritimes); Italy (Piemonte, Liguria).

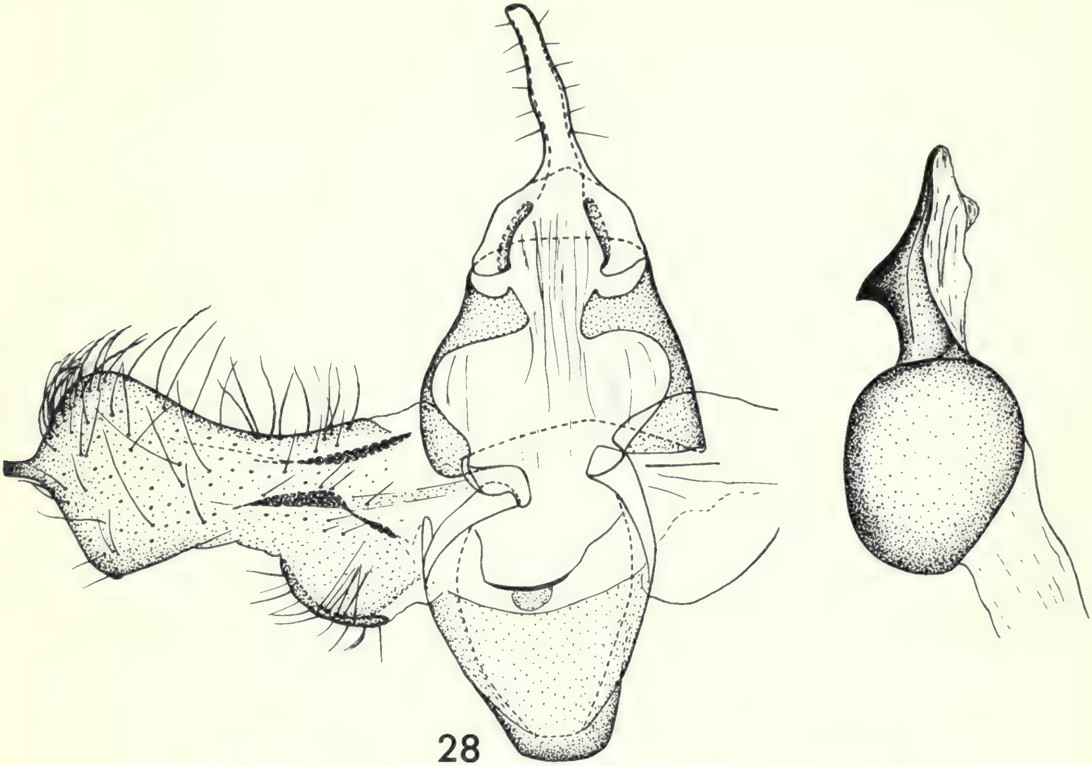


Fig. 28 *Deltophora stictella* (Rebel), ♂ genitalia. Spain, Cataluña (slide no. 443c, Sattler; MZ, Barcelona).

MATERIAL EXAMINED.

Spain: 1 ♂, Cataluña, Balenya, 28.vi.1940 (*Vilarrubia*) (MZ, Barcelona); 1 ♀, Andalucía, Prov. Granada, Sierra de Alfacar, 1500 m, 6.vii.1926 (*Reisser*) (LN, Karlsruhe) (paralectotype); 1 ♂, 2 ♀, Sierra de Alfacar, 8–14.vii.1960 (*Vartian*) (NM, Vienna; coll. Burmann, Innsbruck); 2 ♀, Sierra de Alfacar, 1200 m, 26.vi–8.vii.1962 (*Glaser*) (NM, Vienna); 3 ♂, 8 ♀, Sierra de Alfacar, 1300 m, 3–9.vii.1962 (*Sattler*) (BMNH); 3 ♀, Prov. Granada, Puerto de la Mora, 1400 m, 30.vii.1969 (*Sattler & Carter*) (BMNH); 9 ♂, 21 ♀, Prov. Granada, valley of Rio Fardes, W. of Diezma, 1250 m, 14–20.vii.1962, 22.vi.1968 (*Sattler; Sattler & Carter*) (BMNH); 1 ♂, Prov. Granada, Sierra Nevada, road to Veleta, 2000 m, 27.vii.1969 (*Sattler & Carter*) (BMNH). **France**: 2 ♂, 3 ♀, Basses-Alpes, Digne, vii, 18.vii.1903 (*Chrétien*) (MNHN, Paris); 1 ♂, 3 ♀, [? Basses-Alpes,] Molières, 6.viii.1903 ([*Chrétien*]) (MINGA, Bucharest); 5 ♂, 2 ♀, Basses-Alpes, Digne, Mt Courbons, 16, 18.vii.1969 (*Jäckh*) (coll. Jäckh, Bidingen); 1 ♂, Digne, Vallée Miraux, 15.vii.1969 (*Jäckh*) (coll. Jäckh, Bidingen); 2 ♂, 3 ♀, Digne, Vallée Miraux, Les Dourbes, 17.vii.1969 (*Jäckh*) (coll. Jäckh, Bidingen); 1 ♀, Digne, Les Dourbes, 700 m, 9–11.vii.1962 (*Arenberger*) (coll. Arenberger, Vienna); 4 ♂, Basses-Alpes, St-André-les-Alpes, 31.vii.1915, 2, 4.viii.1917 (*Viard*) (MNHN, Paris); 5 ♂, Basses-Alpes, Annôt, 700 m ('2300 feet'), 1.viii.1913 (*Walsingham*) (BMNH); 2 ♀, Alpes-Maritimes, Belvédère, 2, 8.viii.1920 (*Lhomme*) (MNHN, Paris); 1 ♂, 1 ♀, Alpes-Maritimes, Peira Cava, 1500 m ('4800 feet'), 14, 15.viii.1911 (*Walsingham*) (BMNH) [first record for France]. **Italy**: 4 ♀, Piemonte, Val Susa, Rocciamelone, 1000 m, 22.vi.1959, 18.vii.1965, 23.vii.1966 (*Jäckh*) (coll. Jäckh, Bidingen); 1 ♂, 1 ♀, Liguria, Passo di Teglia, 1100 m, 15.viii.1968 (*Jäckh*) (coll. Jäckh, Bidingen) [first record for Italy].

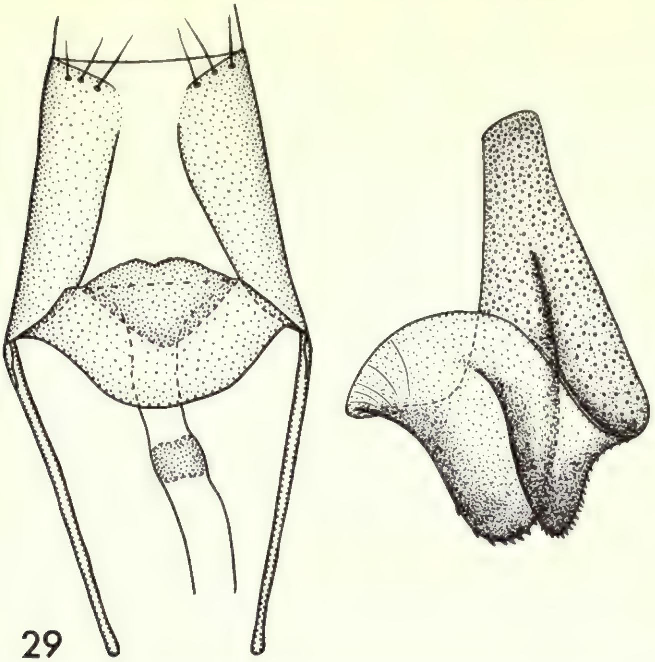


Fig. 29 *Deltophora stictella* (Rebel), ♀ genitalia. Spain, Andalucía (slide no. 12 730; BMNH).

The *korbi*-group

Genitalia ♂. Uncus hook simple. Valva broad, distally not dilated. Sacculus small, not separated from valva. Juxta absent. Ductus ejaculatorius without sclerotized lamina.

Genitalia ♀. Unknown.

Distribution. E. Asia.

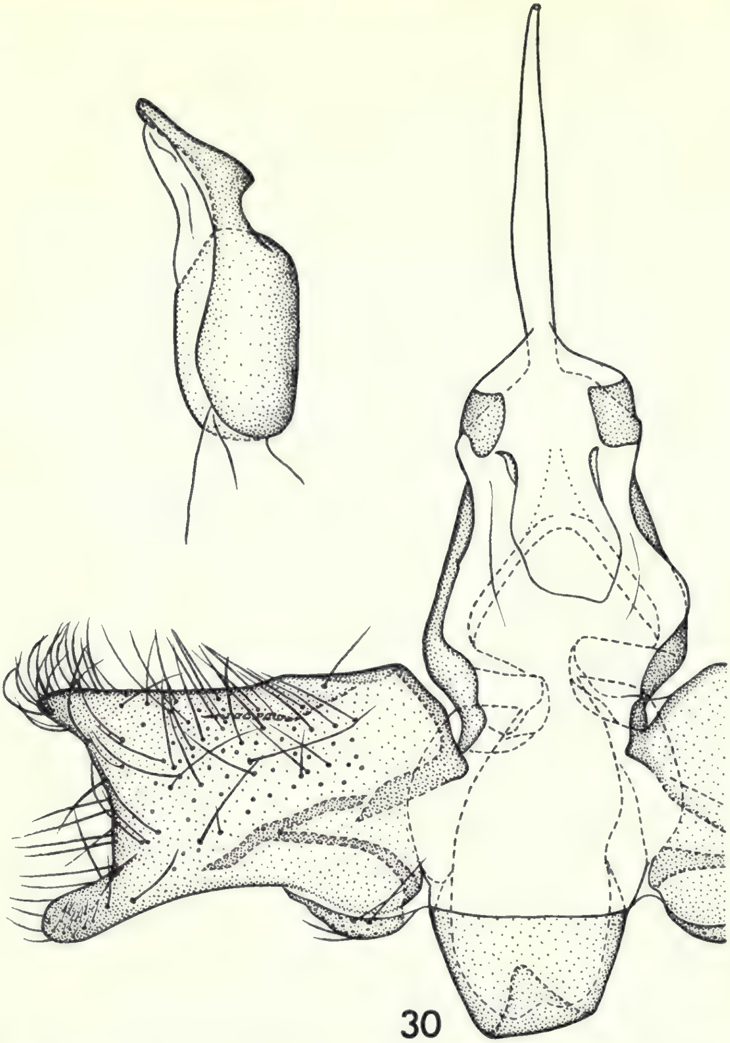
Deltophora korbi (Caradja, 1920) comb. n.

(Figs 30, 49, 74)

Teleia korbi Caradja, 1920, *Dt. ent. Z. Iris* **34** : 105. Holotype ♂, U.S.S.R.: Khabarovsk, Kazakevicha ('Kasakewitsch'), [1907 (*Korb*)] (genitalia slide no. 1075; MINGA, Bucharest) [examined].
[*Aristotelia maculata* (Staudinger); Meyrick, 1925 : 47 (partim). Misidentification.]
Aristotelia korbi (Caradja) Gaede, 1937 : 62.

♂. 5·5 mm. Head ochreous. Labial palpus as head; second segment unmarked; third segment with apex and broad ring around middle brown. Antenna dark brown, with light rings above. Thorax dark brown. Tegula with brown base and lighter apex. Fore wing greyish brown with dark markings: small spots on costa at base, one-fifth and three-fifths; plical spot at one-fifth, not extended to dorsal margin; discal spot big, round, not extended to dorsal margin; spot at end of cell distinct, not extended to tornus. Apical portion of wing dark.

Genitalia ♂ (Figs 30, 74). Uncus hook simple, as long as tegumen. Anterior margin of tegumen with wide triangular emargination. Valva broad, margins almost parallel; costal margin with obtuse angle near base, distal four-fifths almost straight; distal margin concave between apex and rounded projection at ventro-distal angle of valva. Sacculus not separated from valva, reduced to narrow setose fold on basal third of valva. Sacculus smaller than tegumen. Basal two-thirds of aedeagus inflated, sclerotized; dorsal portion of apical third membranous, ventral portion sclerotized, with strong thorn. Ductus ejaculatorius without sclerotized lamina.



30

Fig. 30 *Deltophora korbi* (Caradja), ♂ genitalia. Holotype. U.S.S.R., Khabarovsk (slide no. 1075; MINGA, Bucharest).

GENITALIA ♀. Unknown.

REMARKS. In the left hind wing the veins *RR* and M_1 are separate whereas they sit on a short common stalk in the right wing.

D. korbi differs externally from *maculata* by the broader wings and the fore wing markings. The big, rounded discal spot does not reach the dorsal margin; the smaller spot at the end of the cell is isolated (as in *stictella*) and not extended to the tornus. As in *stictella*, the ochreous head contrasts with the brown thorax and greyish brown fore wings, thereby differing from *maculata*. The apex of the hind wing is shorter than in *maculata*; however, the hind wing of the holotype is slightly folded below the apex, which therefore appears a little shorter in Fig. 49 than it is in reality. The ♂ genitalia do not resemble closely those of any other *Deltophora* species.

The type-locality is situated 40 km south-west of Khabarovsk, at the head of the two branches by which the Ussuri river joins the Amur river. According to Caradja (1910 : 106) the holotype was collected by M. Korb in 1907.

Caradja described *korbi* as 'nov. sp. aut var. [of *maculata*]'; Meyrick (1925 : 47) placed it as a doubtful synonym of *maculata*; Gaede (1937 : 62) recorded it correctly as a separate species.

BIOLOGY. Host-plant unknown. No date of capture is recorded for the holotype.

DISTRIBUTION. U.S.S.R. (Khabarovsk).

The *glandiferella*-group

GENITALIA ♂. Uncus hook simple. Valva subtriangular, with angled ventral margin. Sacculus composed of two weak lobes. Juxta absent. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀. Posterior margin of seventh abdominal segment with or without pair of pleural pits. Apophyses anteriores inserted medially on anterior margin of eighth sternite near ostium bursae. Inner surface of corpus bursae without spines. Signum of typical shape: strongly curved or almost straight hook.

DISTRIBUTION. N. America.

Deltophora sella (Chambers, 1874) **comb. n., sp. rev.**

(Figs 33, 50–52, 61, 75–77, 98–100, Map 1)

Gelechia sella Chambers, 1874 : 238.

♂, ♀. 5·0–7·0 mm. Head grey-brown, sometimes light brown or ochreous, speckled; dark brown along margin of eye between base of proboscis and antenna. Labial palpus densely speckled with dark brown scales on outer and sometimes ventral surface of first and second segments; second segment with light ring at apex; third segment light, apex and irregular ring around middle brown. Antenna brown, with paler rings above. Thorax grey with pair of dark spots on lateral margin of mesoscutellum; sometimes also with dark longitudinal line on anterior half of thorax. Tegula grey with dark brown base. Fore wing grey or brownish grey, with or without dark markings.

GENITALIA ♂ (Figs 33, 61, 75–77). Length of individual scales of posterior pair of coremata about 35 times their greatest width. Uncus hook simple, narrow at base, widest in posterior half near middle. Anterior margin of tegumen with wide emargination. Valva broad, distally rounded, ventral margin extended in middle to form angle which terminates in short spine. Sacculus divided into two weak lobes; dorsal lobe large, rounded, not clearly separated from valva; ventral lobe much smaller. Saccus broad, rounded. Apical portion of aedeagus as long as its bulbous base, narrow, with strong ventral thorn.

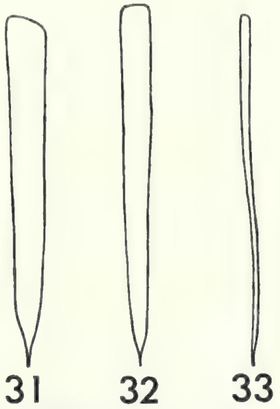
GENITALIA ♀ (Figs 98–100). Posterior margin of seventh abdominal segment without pair of pleural pits. Apophysis anterior one-third to one-half length of apophysis posterior, inserted medially near ostium bursae, pointing outwards. Eighth sternite sclerotized around most of ostium bursae, narrow zone between ostium bursae and posterior margin of sternite membranous. No sclerotized antrum. Posterior part of ductus bursae with sclerotized ring near ostium bursae. Ductus bursae with narrow posterior portion; anterior section gradually widened into elongate corpus bursae. Signum in anterior part of corpus bursae; composed of long, slender, gently and evenly curved spine which arises from narrow sclerotization of bursa wall.

REMARKS. *D. sella* is similar to *glandiferella* and consistently has been synonymized with it.

The ♂ genitalia resemble those of *glandiferella* but in *sella* the scales of the posterior pair of coremata are narrower, hair-like, the base of the uncus is narrow, the valva is longer and more ovoid and its apical margin never bears a small sclerotized thorn; the ventral angle of the valva bears a short spine, whereas in *glandiferella* there is a rectangular or quadrangular sclerotization on the distal side of the ventral angle. In dorso-ventral view the apical portion of the aedeagus is narrower in *sella*, with only one strong ventral thorn, whereas in *glandiferella* it is wider and bears a pair of ventral thorns.

The ♀ genitalia of *sella* are similar to those of *glandiferella* in the medially inserted apophyses anteriores which are directed outwardly. The bases of the apophyses anteriores are not as close as in *glandiferella* and never bent. In *sella* there is no sclerotized antrum developed and the ostium bursae is not completely sclerotized; a wide membranous zone extends between ostium bursae and posterior margin of the eighth sternite. The spine of the signum is gently curved and longer, whereas in *glandiferella* it is strongly curved and stouter. In *glandiferella* the spine of the signum is connected to a scobinate sclerotization of the bursa wall, which runs parallel to the longitudinal axis of the corpus bursae, whereas in *sella* the spine is connected to a narrow sclerotization which is not scobinate and lies at right angles to the longitudinal axis of the corpus bursae.

The Californian subspecies *californica* differs from the nominate form of *sella* by the discal spot which is extended to the dorsal margin of the fore wing. The subspecies *atacta* differs from the nominate form by the absence or near absence of dark wing markings.



Figs 31–33 Scales of posterior pair of coremata. 31, 32, *Deltophora glandiferella* (Zeller). 33, *D. sella* (Chambers).

Chambers (1877 : 14) synonymized *sella* with *glandiferella* and it has remained in synonymy, although Busck (1903 : 789) believed it to be a distinct species. Most literature records of *glandiferella* apply, at least in part, to *sella*, which is the more widespread species in the U.S.A. It seems likely that the records of *glandiferella* from Massachusetts (Jones & Kimball, 1943 : 171) and Connecticut to Kansas (Forbes, 1923 : 293) refer to *sella*.

BIOLOGY. Host-plant unknown. Moths have been collected in March–September and November.

DISTRIBUTION. U.S.A. (North Carolina, Florida, Arkansas, Texas, California).

Deltophora sella sella (Chambers, 1874) **comb. n.**

(Figs 50, 75, 98, 99, Map 1)

Gelechia sella Chambers, 1874, *Can. Ent.* **6** : 238. LECTOTYPE ♂, U.S.A.: Texas (*Chambers*) (genitalia slide no. 712, Sattler; MCZ, Cambridge, Mass.), here designated [examined].

[*Gelechia glandifuella* Zeller; Chambers, 1877 : 14. Incorrect subsequent spelling of *glandiferella* Zeller. Misidentification.]

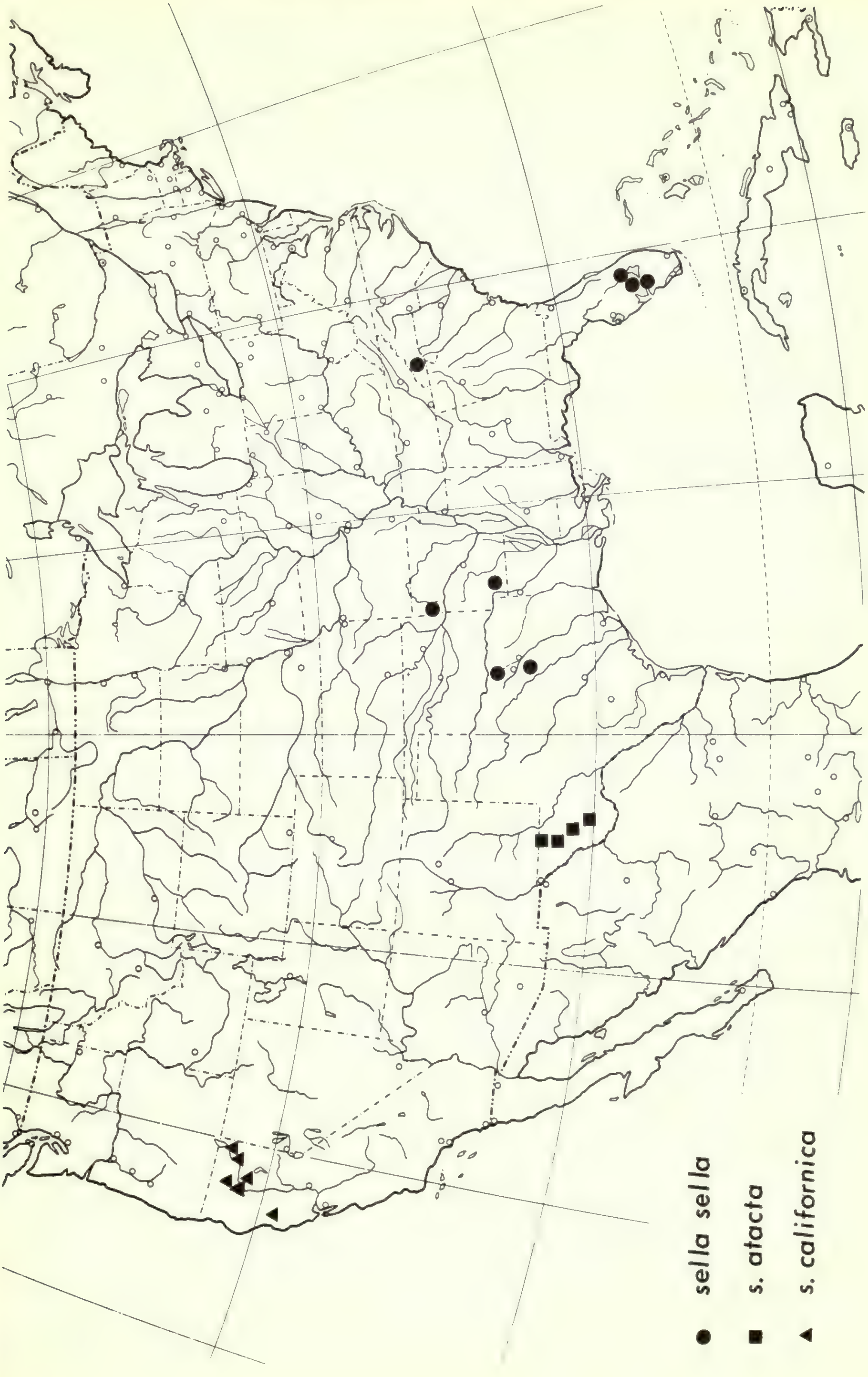
♂, ♀. 5·0–6·0 mm. Fore wing grey with black markings: black spot in fold near base; large discal spot in middle of wing not extended to dorsal margin; small spot at end of cell. Indistinct light spot on costa at three-quarters, rarely extended across wing to tornus. Apex of wing sometimes darker grey.

GENITALIA ♂ (Fig. 75). As described on p. 293.

GENITALIA ♀ (Figs 98, 99). As described on p. 293.

REMARKS. In *sella sella* the discal spot of the fore wing is isolated, whereas in *glandiferella* and *sella californica* it is extended to the dorsal margin.

G. sella was described from an unspecified number of specimens (sex not stated in the original description), which were collected by Chambers during the months of July and September in Texas. It is clear from the original description that Chambers had a mixed series of two species,


● sella sella
■ s. atacta
▲ s. californica

Map 1 Distribution of *Deltophora sella* (Chambers) and its subspecies (based on examined specimens).

viz *sella* s. str. and *glandiferella* Zeller: ' . . . a dark brown dorsal streak, extending more than half across the wing, perpendicular to the margin, placed before the middle [*glandiferella*], but sometimes it is represented only by a triangular spot on the fold, and which does not touch the margin [*sella*]; . . .'. In the Chambers coll. (MCZ, Cambridge, Mass.) there are five original specimens, bearing the following labels: 'Type 1481', 'Chambers, Texas', '*Gelechia sella* Chamb.'. A ♂ without head (genitalia slide no. 712, Sattler) is here designated as the lectotype. The remaining four specimens have been labelled as paralectotypes; however, they are not conspecific with the lectotype but belong to *glandiferella* Zeller. A sixth specimen in the Chambers coll., also labelled 'Type 1481', is excluded from the type-series on account of its date of capture '10/8'. This specimen is conspecific with the lectotype. An original Chambers specimen (♀, without abdomen) in the NMNH, Washington, now also labelled as a paralectotype, belongs to *glandiferella*.

BIOLOGY. Host-plant unknown. Moths have been collected in March–September.

DISTRIBUTION. U.S.A. (North Carolina, Florida, Arkansas, Texas). It seems likely that all records of *glandiferella* from the eastern U.S.A. belong to *sella sella* (see p. 300).

MATERIAL EXAMINED.
U.S.A.: 1 ♀, North Carolina, 1882 (*Morrison*) (BMNH); 1 ♀, North Carolina, Macon Co., Highlands, 1150 m ('3865 feet'), 6.vii.1958 (*Hodges*) (NMNH, Washington); 2 ♂, 8 ♀, Florida, Lake Placid, Archbold Biological Station, 28.iii–4.iv.1959, 30.iv–31.v.1964 (*Hodges*) (NMNH, Washington); 1 ♀, Florida, Highlands Co., Parker Island, 26–29.v.1964 (*Hodges*) (NMNH, Washington); 1 ♂, Florida, Fisheating Creek, Palmdale, 7–10.v.1964 (*Hodges*) (NMNH, Washington); 1 ♂, 4 ♀, Arkansas, Washington Co., Devil's Den State Park, 15–18.vi.1966 (*Hodges*) (NMNH, Washington); 2 ♂, Arkansas, Hempstead Co., Hope, vii, ix.1925 (collector unknown) (BMNH); 1 ♂, Texas, 10.viii (*Chambers*) (MCZ, Cambridge, Mass.); 1 ♂, 1 ♀, Texas, [Montague Co.,] Forestburg, vii.1927, viii.1926 (collector unknown) (BMNH); 1 ♀, Texas, Bosque Co., 20.v.1876 (*Belfrage*) (BMNH); 2 ♂, Texas (*Beutenmüller*) (NMNH, Washington).

Deltophora sella atacta (Meyrick, 1927) **comb. n., stat. n.**

(Figs 51, 61, 76, Map 1)

Aristotelia atacta Meyrick, 1927, *Exot. Microlepidopt.* **3** : 343. Lectotype ♂, U.S.A.: Texas, Brewster Co., Alpine, 1550 m ('5000 feet'), iv.1926 (collector unknown) (genitalia slide no. 5665, Clarke; BMNH), designated by Clarke (1969*a* : 277) [examined].
Aristotelia atacta Meyrick; Gaede, 1937 : 46.
Aristotelia atacta Meyrick; Clarke, 1969*a* : 277, pl. 137, figs 4–4c.

♂. 6·5–7·0 mm. No dark spots on mesoscutellum but dark longitudinal line sometimes present on anterior half. Fore wing pure grey, wing markings reduced: no spots at base; plical, discal and spot at end of cell very small, discal spot slightly distad of plical.

GENITALIA ♂ (Figs 61, 76). As described on p. 293.

GENITALIA ♀. Unknown.

REMARKS. In some specimens of *atacta* the three fore wing spots are completely absent. *D. sella atacta* differs from the nominate subspecies by the larger size, the purer grey colour and the strongly reduced wing markings. It differs from *sella californica* by the grey colour and the reduced fore wing markings; however, reduction of wing markings is occasionally also found in specimens of *californica*.

A. atacta was described from 4 ♂ collected in April, 1926, in Texas. All four specimens were available to me for study. The lectotype was labelled and designated by Clarke (1969*a* : 277); the remaining three specimens (one in BMNH, two in NMNH, Washington) have now been labelled as paralectotypes.

BIOLOGY. Host-plant unknown. Moths have been collected in April, May, July and November.

DISTRIBUTION. U.S.A. (south-western Texas).

MATERIAL EXAMINED.
U.S.A.: 3 ♂, Texas, Brewster Co., 1550 m ('5000 feet'), 2150 m ('7000 feet'), iv.1926 (collector unknown)

(BMNH; NMNH, Washington) (paralectotypes); 1 ♂, Texas, Brewster Co., 2150 m ('7000 feet'), vii.1926 (collector unknown) (BMNH); 1 ♂, Texas, Jeff Davis Co., Fort Davis, 1550 m ('5000 feet'), xi.1927 (collector unknown) (BMNH); 1 ♂, Texas, Culberson Co., Guadalupe mountains, McKittrick Canyon, 1550 m ('5000 feet'), 23.v.1973 (*Hodges*) (NMNH, Washington); 12 ♂, Texas, Culberson Co., Sierra Diablo, 32 km ('20 miles') N.N.W. of Van Horn, 1800 m ('6000 feet'), 26–29.v.1973 (*Hodges*) (NMNH, Washington).

Deltophora sella californica subsp. n.

(Figs 52, 77, 100, Map 1)

[*Telphusa glandiferella* (Zeller); Walsingham, 1911 : 58 (partim). Misidentification.]

♂, ♀. 6·0–7.0 mm. Wing colour brownish grey, fore wing markings dark brown with fine ochreous border. Dark spot at base of fold, big discal spot extended to dorsal margin of fore wing; minute spot at end of cell.

GENITALIA ♂ (Fig. 77). As described on p. 293.

GENITALIA ♀ (Fig. 100). As described on p. 293.

REMARKS. In a number of specimens the fore wing markings are weak and indistinct. In a few specimens the dark spot in the middle of the fore wing is reduced and does not reach the dorsal margin. In one specimen it is divided into a larger plical and a smaller discal spot, thereby resembling the subspecies *atacta*.

D. sella californica differs from the nominate subspecies by the larger size, the more brownish wing colour and the wing markings with the dark spot in the middle of the fore wing reaching the dorsal margin. In this last character *californica* agrees with *glandiferella* and *duplicata*, from both of which it can be separated by the genitalia of both sexes and by the distribution.

Some information on Walsingham's collecting sites in California was published by Essig (1941).

BIOLOGY. Host-plant unknown. Moths have been collected by Walsingham in June–September.

DISTRIBUTION. U.S.A. (California).

Kiefer (1933 : 358) recorded *glandiferella* from California. I was unable to locate his specimens; however, it seems likely that they are *sella californica*.

MATERIAL EXAMINED.

Holotype ♂, **U.S.A.**: California, Shasta Co., Pit River, 21–26.vii.1871 (*Walsingham*) (genitalia slide no. 16 377; BMNH).

Paratypes. **U.S.A.**: 2 ♂, 3 ♀, California, Siskiyou Co., Mt Shasta, 2.viii–1.ix.1871 (*Walsingham*) (BMNH); 1 ♂, California, Siskiyou Co., McCloud's Creek, 29–30.vii.1871 (*Walsingham*) (BMNH); 1 ♂, California, Modoc Co., Davis Creek, 18.viii.1930 (collector unknown) (BMNH); 1 ♀, California, Shasta Co., Pit River, 21–26.vii.1871 (*Walsingham*) (BMNH); 1 ♂, California, Shasta Co., Hatchet Creek, 14–17.vii.1871 (*Walsingham*) (BMNH); 2 ♂, 5 ♀, California, Mendocino Co., Head of Noyo River, 8–11.vi.1871 (*Walsingham*) (BMNH).

Deltophora glandiferella (Zeller, 1873) comb. n.

(Figs 31, 32, 34, 53, 64, 78, 101, 102)

Gelechia (*Anacampsis*) *glandiferella* Zeller, 1873, *Verh. zool.-bot. Ges. Wien* **23** : 275, pl. 4, fig. 25. LECTOTYPE ♂, U.S.A.: Texas, Dallas Co., [1870] (*Boll*) (genitalia side no. 7356; BMNH), here designated [examined].

[*Gelechia sella* Chambers, 1874 : 238 (partim). Misidentification.]

Gelechia glandifuella Zeller; Chambers, 1877*a* : 14 (partim). Incorrect subsequent spelling of *glandiferella* Zeller.

Gelechia glandifera Zeller; Chambers, 1877*b* : 24. Incorrect subsequent spelling of *glandiferella* Zeller.

Gelechia glandiferella Zeller; Chambers, 1878 : 144 (partim).

Gelechia glandiferella Zeller; Hagen, 1884 : 99.

Gelechia glandiferella Zeller; Frey, 1884 : 99 (partim).

Gelechia glandiferella Zeller; Riley, 1891 : 101 (partim).

[*Gelechia*] *glandiferella* Zeller; Busck, 1902 : 93 (partim).

Telphusa glandiferella (Zeller) Busck, 1903 : 788 (partim).
Telphusa glandiferella (Zeller); Busck, [1903] : 497 (partim).
Telphusa glandiferella (Zeller); Kearfott, 1903 : 109 (partim).
Telphusa glandiferella (Zeller); Barnes & McDunnough, 1917 : 154 (partim).
Telphusa glandiferella (Zeller); Forbes, 1923 : 292, 293 (partim).
Telphusa glandiferella (Zeller); Meyrick, 1925 : 70 (partim).
Telphusa glandiferella (Zeller); Gaede, 1937 : 125 (partim).
Telphusa glandiferella (Zeller); McDunnough, 1939 : 68 (partim).

♂, ♀. 5·0–7·0 mm. Head grey-brown to ochreous, speckled with dark brown; some dark brown scales along margin of eye between base of proboscis and antenna. Labial palpus grey-brown to ochreous, outer surface of first and second segments dark brown; second segment with light ring at apex; third segment light, apex and ring around middle dark brown. Antenna grey-brown, with paler rings above. Thorax grey-brown, apex of mesoscutellum and pair of spots on lateral margin dark brown. Tegula grey-brown or ochreous, basal half dark brown. Fore wing grey or grey-brown, with black markings: black spot in fold near base; large discal spot in middle of wing extended to dorsal margin; small spot at end of cell. Dark markings sometimes lined with ochreous. Sometimes very small indistinct dark spots on costa.

GENITALIA ♂ (Figs 31, 32, 34, 78). Length of individual scales of posterior pair of coremata about 10 times their greatest width. Uncus hook simple, narrow, widest at base, tapered posteriorly. Anterior margin of tegumen with wide emargination. Valva broad, apex evenly rounded, often with short sclerotized thorn. Ventral margin of valva extended to form obtuse angle; small angular sclerotization on distal side of angle. Sacculus divided into two weak, irregularly shaped lobes; dorsal lobe clearly separated from valva, usually larger than ventral lobe. Saccus broad, rounded. Apical portion of aedeagus as long as its bulbous base, with pair of strong ventral thorns.

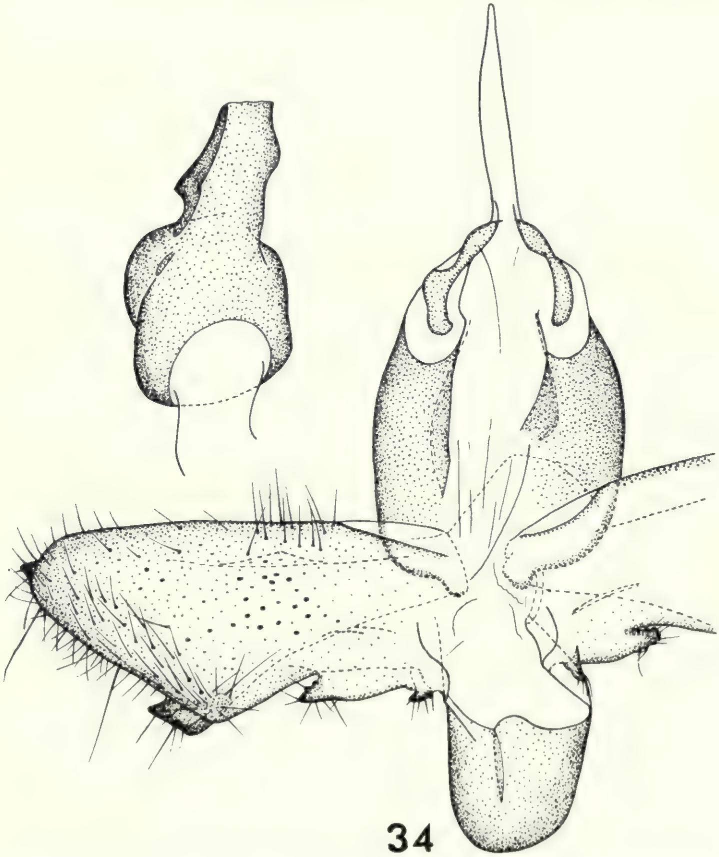


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Fig. 34 *Deltophora glandiferella* (Zeller), ♂ genitalia. Lectotype. U.S.A., Texas (slide no. 7356; BMNH).

Genitalia ♀ (Figs 101, 102). Posterior margin of seventh abdominal segment with pair of shallow pleural pits. Apophysis anterior one-third to one-half length of apophysis posterior, inserted medially on anterior margin of eighth sternite, close to ostium bursae. Inner basal branch of apophysis anterior extended as narrow fold behind ostium bursae; outer basal branch sometimes extended in gentle arc to centre of eighth sternite. Apophysis anterior strongly bent outwards near base. Sclerotized antrum short, rounded, posterior margin of ventral antrum wall with deep emargination. Posterior part of ductus bursae with sclerotized ring near antrum. Ductus bursae with narrow posterior portion; anterior portion gradually widened into elongate corpus bursae. Signum in posterior part of corpus bursae, composed of curved, stout spine which arises from scobinate longitudinal sclerotization of bursa wall.

Remarks. The distal portion of the valva is variable. The apical margin is usually, but not always, evenly rounded and sometimes bears a small tooth or other sclerotization. Seen laterally the two ventral thorns on the apical portion of the aedeagus may appear as one.

The ♀ genitalia share with those of *sella* the medially inserted and outwardly directed apophyses anteriores. For differences see *sella* (p. 293). The apophyses anteriores are bent near their base to a varying degree; rarely they are straight as in *sella*. The inner basal branches of the apophyses anteriores extend behind the ostium bursae but do not quite meet medially, leaving a narrow membranous gap. There is usually no outer basal branch visible; however, sometimes a gently curved stronger sclerotization extends from the base of the apophyses anteriores to the centre of the eighth sternite. The sclerotization of the eighth sternite is often weak and the membranous and sclerotized areas are usually not clearly separated. Sometimes there is a large, transverse, membranous area behind the ostium bursae, followed by a narrow, longitudinal, membranous zone which extends to the posterior margin of the sternite.

D. glandiferella was described from an unspecified number of specimens of both sexes, collected in Texas by Boll and Belfrage. Zeller specifically mentioned four ♀ collected on 27.vii, 7 and 27.viii. Material collected by Boll in Dallas Co. in 1870, usually without recorded dates of capture, was made available to Zeller by Hagen. The above lectotype bears Zeller's green label [green labels were Zeller's code for the American fauna] '*Gelechia glandiferella*, Texas, H[a]g[en]. [18]71.', indicating that Zeller had received the specimen from Hagen in 1871. Material collected by Belfrage in Texas, usually with recorded dates of capture, was made available to Zeller by Stainton and Loew. In coll. Zeller (BMNH) there are two ♀ from Texas with dates 7.viii and 27.viii respectively. They bear Zeller's green label '*glandiferella*, Texas, L[oe]w. [18]71.'. A ♀ in NMNH, Washington, bears an identical Zeller label and was captured on 25.vii. It also bears a printed label 'From Boll Texas'; this is incorrect as the other labels indicate that the specimen was collected by Belfrage. Although the date does not agree with those cited in the original description, it is probably one of the original specimens. I have now labelled it as '? Paralectotype'. All three specimens lack the abdomens. For information on the origin of Zeller's material see Zeller (1872 : 449–450).

Riley (1891 : 101, no. 5382) erroneously placed *pallidochrella* Chambers as a synonym of *glandiferella*, but at the same time (loc.cit. : 102, no. 5439) recorded it as a valid species. This error was corrected and discussed in detail by Busck (1902 : 93).

D. glandiferella is externally very similar to *sella californica* and *duplicata* but can be distinguished by the genitalia. The differences to *sella* and its subspecies *californica* are discussed on p. 293. In the *duplicata* ♂ the valva is rectangular rather than triangular and bears a pair of finger-like sclerotized processes. In the *duplicata* ♀ the apophyses anteriores are not inserted medially on the margin of the eighth sternite, the ductus bursae is shorter and much wider and bears a large sclerotization in its posterior part just before the colliculum. The spine of the signum is thinner and much longer than in *glandiferella*.

Biology. Host-plant unknown. Moths have been collected in April–August and October.

Distribution. U.S.A. (Texas); Mexico (Coahuila, Nuevo Leon, Tamaulipas).

Walsingham, followed by several authors, recorded *glandiferella* from California, Mexico and the West Indies. Re-examination of the material concerned has revealed the following misidentifications: California (Walsingham, 1911 : 58) – *sella californica*; Mexico (Walsingham, 1911 : 58)

– *flavocincta* [it should, however, be noted that *glandiferella* is now known to occur in Mexico.]; West Indies (Walsingham, 1897 : 72; 1911 : 58) – *lanceella.*

I was unable to locate the specimens recorded from California by Keifer (1933 : 358); it seems likely that they also belong to *sella californica.*

In the U.S.A. *glandiferella* is only known with certainty from Texas; it seems likely that all records for the eastern U.S.A., e.g. Massachusetts (Jones & Kimball, 1943 : 171) and Connecticut to Kansas (Forbes, 1923 : 293) refer to *sella* (see p. 296).

MATERIAL EXAMINED.

U.S.A.: 3 ♂, 2 ♀, Texas (*Chambers*) (MCZ, Cambridge, Mass.; NMNH, Washington) (paralectotypes of *G. sella* Chambers); 1 ♀, Texas, [Montague Co.,] Forestburg, viii.1927 (collector unknown) (BMNH); 1 ♀, Texas, Bosque Co., 25.x.1876 (*Belfrage*) (BMNH); 13 ♂, 5 ♀, Texas, Brewster Co., 1550, 2150, 2450 m ('5000 feet', '7000 feet', '8000 feet'), iv, v, vii.1926 (collector unknown) (BMNH); 2 ♂, Texas, Brewster Co., Chisos mountains, Panther Pass, 1800 m ('6000 feet'), 2.vi.1973 (*Hodges*) (NMNH, Washington); 1 ♂, 1 ♀, Texas, Brewster Co., Chisos mountains, K-Bar Ranch, 1000 m ('3400 feet'), 5.vi.1973 (*Hodges*) (NMNH, Washington); 1 ♂, Texas, Culberson Co., Sierra Diablo, 32 km ('20 miles') N.N.W. of Van Horn, 1800 m ('6000 feet'), 29.v.1973 (*Hodges*) (NMNH, Washington); 1 ♂, Texas, [Kerr Co.,] Kerrville (collector unknown) (NMNH, Washington); 1 ♂, Texas (*Beutenmüller*) (NMNH, Washington). **Mexico**: 1 ♂, Coahuila, 16 km ('10 miles') N. of Monclova, 450 m ('1500 feet'), 7.vii.1963 (*Duckworth & Davis*) (NMNH, Washington); 3 ♂, 1 ♀, Nuevo Leon, Anegade Arroya, 26 km ('16 miles') S. of Linares, 400 m ('1250 feet'), 9.vii.1963 (*Duckworth & Davis*) (NMNH, Washington); 1 ♀, Tamaulipas, 3 km ('2 miles') N. of Tamazunchale, 120 m ('400 feet'), 16–18.vii.1963 (*Duckworth & Davis*) (NMNH, Washington); 1 ♀, Tamaulipas, 9·5 km ('6 miles') S. of Ciudad Victoria, 300 m ('1050 feet'), 6.viii.1963 (*Duckworth & Davis*) (NMNH, Washington).

The *flavocincta*-group

GENITALIA ♂. Eighth tergite sometimes specialized (see also p. 271). Uncus simple or dilated. Sometimes a weakly sclerotized subscaphium present. Valva of various shape, with or without digitate processes near base. Sacculus small, not clearly separated from valva. Sclerotized juxta usually present. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀. Posterior margin of seventh abdominal segment with or without pleural pits. Ventral branch of apophysis anterior extended into ostium bursae. Ductus bursae sometimes with sclerotization anterior to colliculum. Corpus bursae with or without minute spines. Signum usually a large hook with compressed apical portion.

DISTRIBUTION. N. America (Florida); Central America; northern parts of S. America.

Deltophora flavocincta sp. n.

(Figs 54, 79, 103, 104)

[*Telphusa glandiferella* (Zeller); Walsingham, 1911 : 58 (partim). Misidentification.]

♂, ♀. 5·0–6·0 mm. Head ochreous, speckled with dark brown, particularly on vertex, along margin of eye and at base of antenna. Labial palpus ochreous, outer surface of first and second segments dark brown; second segment with light ring at apex; third segment with dark apex and broad, dark ring around middle. Antenna brown with paler rings above. Thorax ochreous with broad, dark, longitudinal band, pair of dark lateral spots and dark apex of mesoscutellum. Tegula ochreous, basal half dark brown. Fore wing ochreous, paler than head, with black markings: small spot in fold, near base, extended towards dorsal margin; large discal spot extended to dorsal margin, widest on margin; sometimes minute spot at end of cell; dark shadow on third quarter of costa. Dark markings sometimes lined with ochreous scales. Apical portion of wing light, not darker than basal area.

GENITALIA ♂ (Fig. 79). Uncus hook as long as tegumen, medially slightly dilated, apical quarter thin. Anterior margin of tegumen medially with wide emargination. Anal tube with long, narrow subscaphium. Valva distally dilated; costal margin strongly convex, ventral margin straight; band along costal and distal margin set with long setae, nose-like apex free of setae. Sacculus only about one-third length of valva, set with very long setae. Base of sacculus extends as more strongly sclerotized fold across basal third of valva and nearly reaches costal margin. Juxta almost rectangular, strongly sclerotized. Basal two-thirds of aedeagus inflated, sclerotized; dorsal portion of apical third membranous, ventral portion sclerotized, with pair of strong ventral thorns. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Figs 103, 104). Apophysis posterior 3 times length of apophysis anterior. Eighth sternite membranous, between anterior margin and ostium bursae weakly sclerotized, anterior margin strongly convex. Ostium bursae at anterior third of eighth sternite. Antrum a large, anteriorly rounded pouch; posterior margin with V-shaped emargination. Ventral branch from base of apophysis anterior reaches posterior edge of antrum. Colliculum close to antrum. Ductus bursae about 3 times length of apophysis posterior, with one loop; at entrance of corpus bursae about 4 to 5 times as wide as at colliculum. Corpus bursae oval, inner surface with minute spines in posterior part extending into extreme anterior portion of ductus bursae. Signum composed of flat blade with serrated edge and narrower basal arm which branches off at right angles.

REMARKS. *D. flavocincta* is lighter and more ochreous than its related species. The ♂ genitalia differ from those of *lanceella*, *caymana* and *minuta* by the narrow uncus, from *duplicata* by the absence of the digitate processes of the valva. The ♀ genitalia are closest to those of *lanceella* but differ by the shorter apophyses anteriores, the much longer ductus bursae with one loop, and the shorter, more robust signum.

BIOLOGY. Host-plant unknown. Moths have been collected in February and June–August at altitudes of 300–600 m.

DISTRIBUTION. Mexico (Tamaulipas, Tabasco); Colombia (Magdalena).

MATERIAL EXAMINED.
Holotype ♂, **Colombia**: Magdalena, Sierra Nevada de Santa Marta, Minca, 600 m ('2000 feet'), vi.1899 (*Smith*) (genitalia slide no. 14 816; BMNH).

Paratypes. **Mexico**: 2 ♂, Tamaulipas, 9·5 km ('6 miles') S. of Ciudad Victoria, 300 m ('1050 feet'), 6.viii.1963 (*Duckworth & Davis*) (NMNH, Washington); 1 ♂, 6·5 km ('4 miles') S.W. of Ciudad Victoria, 350 m ('1100 feet'), 10.vii.1963 (*Duckworth & Davis*) (NMNH, Washington); 1 ♀, Tabasco, Teapa, ii.18 [??] (*Smith*) (BMNH). **Colombia**: 1 ♂, 2 ♀, Magdalena, Sierra Nevada de Santa Marta, Minca, 600 m ('2000 feet'), vi.1899 (*Smith*) (BMNH).

Deltophora duplicata sp. n.

(Figs 13, 58, 62, 80, 105, 106)

♂, ♀. 4·5–5·5 mm. Head grey-brown, speckled with darker brown, particularly on vertex; dark brown scales along margin of eye. Labial palpus whitish grey or ochreous, outer surface of first and second segments dark brown; second segment with light ring at apex; third segment with dark apex and irregular dark ring around middle. Antenna dark brown, with lighter rings above. Thorax grey-brown, middle sometimes darker, pair of dark lateral spots sometimes indistinct, apex of mesoscutellum dark. Tegula grey-brown, basal two-thirds dark brown. Fore wing grey, grey-brown or pale ochreous, with black markings: plical spot and discal spot both extended to dorsal margin; minute spot at end of cell, not extended to tornus. Base of costa dark, small dark spot on basal fifth, sometimes indistinct dark shadow on third quarter of costa. Dark wing markings sometimes lined with ochreous scales.

GENITALIA ♂ (Figs 13, 62, 80). Eighth tergite specialized, scale bases concentrated medially in posterior two-thirds. Anterior pair of coremata short, about length of two abdominal segments (twice length of posterior pair), composed of tuft of long, hair-like scales and group of strong, heavily sclerotized scales, one of which exceeds others in length and is characteristically curled below apex (Fig. 13). Posterior pair of coremata composed of broad scales; length of individual scale about 3 times its greatest width. Uncus hook simple, as long as tegumen. Anterior margin of tegumen medially with wide trapezoidal emargination. Valva about twice as long as wide, margins almost straight, parallel; costal and distal margins meet at obtuse angle; ventro-distal corner extended to short, nose-like apex. Short digitate process near centre of valva; longer, slightly curved process on ventral margin, near base. Valva almost entirely covered with long setae. Sacculus much reduced, divided; dorsal part more strongly sclerotized, margin slightly convex, with group of long setae; ventral part smaller, weakly sclerotized, margin with three shorter setae. Small sclerotized juxta present. Saccus as large as tegumen. Basal third of aedeagus inflated; apical two-thirds membranous, supported by ventral sclerotization which bears pair of short teeth near middle. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Figs 105, 106). Apophysis posterior twice length of apophysis anterior. Posterior part of eighth sternite membranous, anterior part sclerotized, anterior margin medially strongly convex. Ventral branch from base of apophysis anterior strongly recurved at ostium bursae and extended into antrum. Ostium bursae in middle of eighth sternite, ventral margin convex. Ventral surface of antrum with tapered sclerotization. Colliculum very close to antrum. Ductus bursae about as long as apophysis posterior, at entrance of corpus bursae 3 to 4 times as wide as at colliculum, with lateral sclerotization in posterior half. Corpus bursae spherical or oval. Signum strongly curved, pointed, with small base plate branching off at right angles; basal half tubular, apical half compressed, strongly curved; one edge serrate.

REMARKS. *D. duplicata* is characterized externally by the strong plical spot which reaches the dorsal margin of the fore wing. The ♂ genitalia differ from those of all other species by the two digitate processes of the valva; the ♀ genitalia differ by the sclerotization of the ductus bursae anterior to the colliculum. The only other species with a similar sclerotization, *minuta*, differs from *duplicata* by the straight apical portion of the signum.

BIOLOGY. Host-plant unknown. Moths have been collected in February, May, July and August.

DISTRIBUTION. U.S.A. (Florida); Cayman Islands; Mexico (Tamaulipas); El Salvador.

MATERIAL EXAMINED.
Holotype ♂, **Cayman Islands**: Grand Cayman, West end of Georgetown, 3.viii.1938 (*Lewis & Thompson*) (genitalia slide no. 14 829; BMNH).

Paratypes. **U.S.A.**: 1 ♂, 2 ♀, Florida, Lake Placid, Archbold Biological Station, 1–7, 16–22.v.1964 (*Hodges*) (NMNH, Washington). **Mexico**: 1 ♂, Tamaulipas, 3 km ('2 miles') N. of Tamazunchale, 120 m ('400 feet'), 16–18.vii.1963 (*Duckworth & Davis*) (NMNH, Washington); 1 ♀, Tamaulipas, El Salto Falls, 42 km ('26 miles') W. of Antiguo Morelos, 600 m ('2000 feet'), 11–14.vii.1963 (*Duckworth & Davis*) (NMNH, Washington). **El Salvador**: 1 ♀, Quezaltepeque, 11.ii.1965 (*Duckworth*) (NMNH, Washington).

Deltophora lanceella sp. n.

(Figs 55, 81, 107, 108)

[*Xenolechia glandiferella* (Zeller) Walsingham, 1897 : 72. Misidentification.]
[*Telphusa glandiferella* (Zeller); Walsingham, 1911 : 58 (partim). Misidentification.]
[*Aristotelia peltosema* (Lower); Meyrick, 1925 : 47 (partim). Misidentification.]
[*Telphusa glandiferella* (Zeller); Meyrick, 1925 : 70 (partim). Misidentification.]
[*Aristotelia peltosema* (Lower); Gaede, 1937 : 69 (partim). Misidentification.]
[*Tephusa glandiferella* (Zeller); Gaede, 1937 : 125 (partim). Misidentification.]

♂, ♀. 5·0–5·5 mm. Head light brown or ochreous, speckled with darker brown; some dark scales on margin of eye. Labial palpus ochreous, outer surface of first and second segments dark brown; second segment with light ring at apex; third segment with dark apex and ring around middle. Antenna dark brown, with lighter rings above. Thorax light brown or ochreous, sometimes middle darker brown. Tegula ochreous with dark brown base. Fore wing grey-brown with black markings: spot in fold near base extended towards dorsal margin but normally not reaching it; large discal spot extended to dorsal margin; minute spot at end of cell; sometimes faint shadow on tornus; small spot at basal quarter and larger shadow on third quarter of costa. Wing with extended areas of ochreous scales, particularly around dark markings. Apical portion of wing not darker than basal area.

GENITALIA ♂ (Fig. 81). Uncus broadly lanceolate with short sharp point, about as long as tegumen. Anterior margin of tegumen with wide triangular emargination which reaches middle. Valva pointed; costal margin straight between base and hump at two-thirds; apical third of valva tapered; ventral margin very gently curved with digitate process at base. Sacculus much reduced, composed of triangular sclerotized fold, which is joined to base of valva, and irregularly shaped membranous lobe. Juxta a narrow plate, twice as wide as long. Aedeagus sclerotized except for dorsal part, base inflated, ventral thorn or transverse ridge at apical third. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Figs 107, 108). Apophysis posterior twice length of apophysis anterior. Posterior part of eighth sternite membranous, anterior part sclerotized, anterior margin convex. Ventral branch from base of apophysis anterior strongly recurved at ostium bursae and extended into antrum. Ostium bursae near middle of eighth sternite, ventral margin concave. Ventral surface of antrum with tapered or rounded sclerotization. Colliculum very close to antrum. Ductus bursae evenly dilated anteriorly, corpus bursae not clearly separated. Signum strongly curved, pointed, small base plate branching off at right angles; basal half tubular, apical half compressed, strongly curved, one edge serrate.

REMARKS. *D. lanceella* differs from *caymana* and *minuta* by the larger size, from *flavocincta* by the grey (not ochreous) fore wings, from *duplicata* by the plical spot which does not reach the dorsal margin of the fore wing, and from *suffusella* by the distinct wing markings. The ♂ genitalia are closest to those of *minuta* but differ by the tapered valva; they differ from those of *caymana* by the shape of the uncus and valva and the presence of a digitate process on the ventral margin of the valva. In the ♀ genitalia the strongly curved signum with the long narrow apex distinguishes *lanceella* from all related species; *duplicata*, with a similar but shorter signum, has an additional sclerotization in the ductus bursae near the colliculum. In *lanceella* the structure of the eighth segment is similar to that of *flavocincta*; however, the latter has a shorter and wider signum and a much longer ductus bursae with one loop.

BIOLOGY. Host-plant unknown. Moths have been collected in January and February.

DISTRIBUTION. West Indies (Grenada); Guyana; Brazil (Pará).

MATERIAL EXAMINED.
Holotype ♂, **Guyana**: Bartica, i.1913 (*Parish*) (genitalia slide no. 13 862; BMNH).
Paratypes. **West Indies**: 2 ♀, Grenada, leeward side, Mount Gay Estate, [100 m ('300 feet'), 25–30.viii] (*Smith*) (BMNH). **Brazil**: 1 ♀, Amazons, Pará, ii.1893 (*Schulz*) (BMNH).

Deltophora caymana sp. n.

(Figs 56, 82)

♂. 3·5–4·0 mm. Head grey-brown, speckled with darker scales. Labial palpus mostly dark brown; second segment with light dorsum and narrow light ring at apex; third segment with light zones at one-third and two-thirds. Antenna dark brown, with lighter rings above. Thorax grey-brown. Tegula grey-brown, with dark brown base. Fore wing grey-brown, with black markings: discal spot narrow, extended to dorsal margin and nearly reaching costa; small spot at end of cell. Dark markings in places lined with ochreous.

GENITALIA ♂ (Fig. 82). Uncus broad, leaf-shaped, slightly longer than tegumen, about 2 to 3 times as long as wide. Anterior margin of tegumen medially with deep arcuate emargination which nearly reaches base of uncus. Valva hardly dilated distally, broad, about twice as long as wide; costal margin slightly curved at basal third, distal two-thirds almost straight; distal margin convex; ventro-distal corner extended ventrad to form strong thorn. Sacculus about half length of valva, not separated from its ventral margin. Juxta reduced to small sclerotization on posterior margin of saccus. Saccus broad, about size of tegumen. Basal half of aedeagus inflated, sclerotized; dorsal portion of apical half membranous, ventral portion sclerotized, with pair of strong thorns near middle. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀. Unknown.

REMARKS. *D. caymana* is smaller than most *Deltophora* species; it differs from the equally small *minuta* by the darker wing colour. *D. duplicata*, the only other *Deltophora* known from the Cayman Islands, is bigger and differs by the strongly developed plical spot which reaches the dorsal margin of the fore wing. In the ♂ genitalia *caymana* is characterized by the broad, leaf-shaped uncus which distinguishes it from all other *Deltophora* species.

The four type-specimens are in rather poor condition.

BIOLOGY. Host-plant unknown. Moths have been collected in May and July.

DISTRIBUTION. Cayman Islands.

MATERIAL EXAMINED.
Holotype ♂, **Cayman Islands**: Grand Cayman, N. coast of N. side, hut road, 15.vii.1938 (*Lewis & Thompson*) (genitalia slide no. 20 693; BMNH).
Paratypes. **Cayman Islands**: 2 ♂, same data as holotype (BMNH); 1 ♂, Cayman Brac, W. end of Cotton-tree Land, 20.v.1938 (*Lewis & Thompson*) (BMNH).

Deltophora minuta sp. n.

(Figs 57, 83, 109, 110)

[*Aristotelia peltosema* (Lower); Meyrick, 1925 : 47 (partim). Misidentification.]
[*Aristotelia peltosema* (Lower); Gaede, 1937 : 69 (partim). Misidentification.]

♂, ♀. 3·5–4·0 mm. Head grey-brown, speckled, dark brown along margin of eye. Labial palpus pale ochreous to whitish; second segment mostly dark brown, with light ring at apex; third segment with dark ring around middle and some dark scales at apex. Antenna dark brown, with paler rings above. Thorax grey-brown to light brown. Tegula light brown with dark brown base. Fore wing grey-brown with black or dark brown markings: small spot in fold near base; large discal spot extended to dorsal margin; small spot at end of cell; dark spots on costa at base, one-quarter, shadow at three-quarters. Dark markings lined with ochreous scales. Apical portion of wing not darker than basal area.

GENITALIA ♂ (Fig. 83). Uncus as long as tegumen, nearly as broad as valva; basal fifth evenly expanded, following two-fifths with parallel margins, apical two-fifths tapered. Anterior margin of tegumen medially with deep narrow emargination which reaches posterior quarter. Valva slightly narrower than uncus, with parallel margins, distally rounded, apex with strong spine; short hook at base of ventral margin. Sacculus reduced, not clearly separated from valva, composed of sclerotized dorsal and membranous ventral portion. Small sclerite on posterior margin of saccus may represent vestige of juxta. Saccus about as long as tegumen but narrower. Basal half of aedeagus inflated, sclerotized; dorsal portion of apical half membranous, ventral portion sclerotized, with pair of triangular teeth near base. Ductus ejaculatorius without sclerotized lamina.

GENITALIA ♀ (Figs 109, 110). Apophysis posterior 3 times length of apophysis anterior. Posterior part of eighth sternite membranous, anterior part weakly sclerotized, raised to broad tongue below ostium bursae; anterior margin straight. Ostium bursae in middle of eighth sternite. Antrum membranous with pair of sclerotized plates. Colliculum at posterior third of ductus bursae; narrow sclerotization extends between colliculum and entrance of corpus bursae. Ductus bursae about length of apophysis posterior, anteriorly not dilated. Corpus bursae pear-shaped, inner surface of anterior half with minute spines. Signum long, straight, with rounded apex, edge with fine serration; large curved base plate branches off at slightly acute angle.

REMARKS. *D. minuta* can be distinguished from most allied species by the small size; it differs from the equally small *caymana* by the lighter wing colour. The ♂ genitalia are closest to those of *lanceella* but uncus and valva have parallel margins, the tegumen has a much deeper anterior emargination, the saccus is longer and narrower and the aedeagus is clearly divided into a bulbous base and a narrow apical portion. The ♂ genitalia of *caymana* differ from those of *minuta* by the broad leaf-shaped uncus and the absence of a curved process at the base of the valva. In the ♀ genitalia *minuta* can be distinguished from all other *Deltophora* species by the long sclerotization of the ductus bursae and the long straight apical portion of the signum.

BIOLOGY. Host-plant unknown. Moths have been collected in August and September.

DISTRIBUTION. Brazil (Amazon).

MATERIAL EXAMINED.
Holotype ♂, **Brazil**: Amazon, Obidos, ix.1919 (*Parish*) (genitalia slide no. 14 833; BMNH).
Paratype. **Brazil**: 1 ♀, Amazon, Santarem, viii.1919 (*Parish*) (BMNH).

Deltophora suffusella sp. n.

(Figs 59, 111–113)

[*Aristotelia peltosema* (Lower); Meyrick, 1931 : 278. Misidentification.]
[*Aristotelia peltosema* (Lower); Gaede, 1937 : 69 (partim). Misidentification.]

♀. 5·0 mm. Head ochreous to light brown. Labial palpus ochreous to whitish, densely mixed with brown; outer surface of first segment brown; second segment with light ring on apex, outer surface brown, inner surface with scattered brown scales; third segment with dark base and brown ring around middle. Antenna brown, with paler rings above. Thorax brown. Tegula brown with lighter apex. Fore wing grey-brown with blurred dark brown markings: base and distal half of costa dark, small spot at first quarter of costa; large discal spot extended to dorsal margin. Apex not darker than rest of wing.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Figs 111–113). Apophysis posterior 1·5 times length of apophysis anterior. Eighth segment with ventro-lateral pair of large ear-like lobes which originate near base of apophysis anterior and extend to posterior margin of segment. Ostium bursae on anterior margin of eighth sternite, almost as wide as sternite. Posterior part of ductus bursae sclerotized to length of apophysis anterior, composed of three sections. Antrum three-quarters length of apophysis anterior, inner wall with large triangular posterior sclerotization. Colliculum touches antrum. Ductus bursae with sclerotization directly anterior to colliculum. No clear separation of ductus and corpus bursae; ductus evenly dilated from antrum. Anterior portion of corpus bursae with minute spines. Signum strongly curved hook with large base, situated in posterior portion of corpus bursae which is not spined.

REMARKS. *D. suffusella* is distinguished externally from all other South American *Deltophora* species by the indistinct wing markings. The ♀ genitalia are characterized by the ear-like lobes of the eighth segment which distinguish *suffusella* from all other *Deltophora* species.

BIOLOGY. Host-plant unknown. Moths have been collected in October and November.

DISTRIBUTION. Paraguay (Chaco).

MATERIAL EXAMINED.
Holotype ♀, **Paraguay**: Chaco, Makthlawaiya, x.1926 (*Carter*) (genitalia slide no. 14 840; BMNH).
Paratype. **Paraguay**: 1 ♀, Chaco, Makthlawaiya, xi.1926 (*Carter*) (BMNH).

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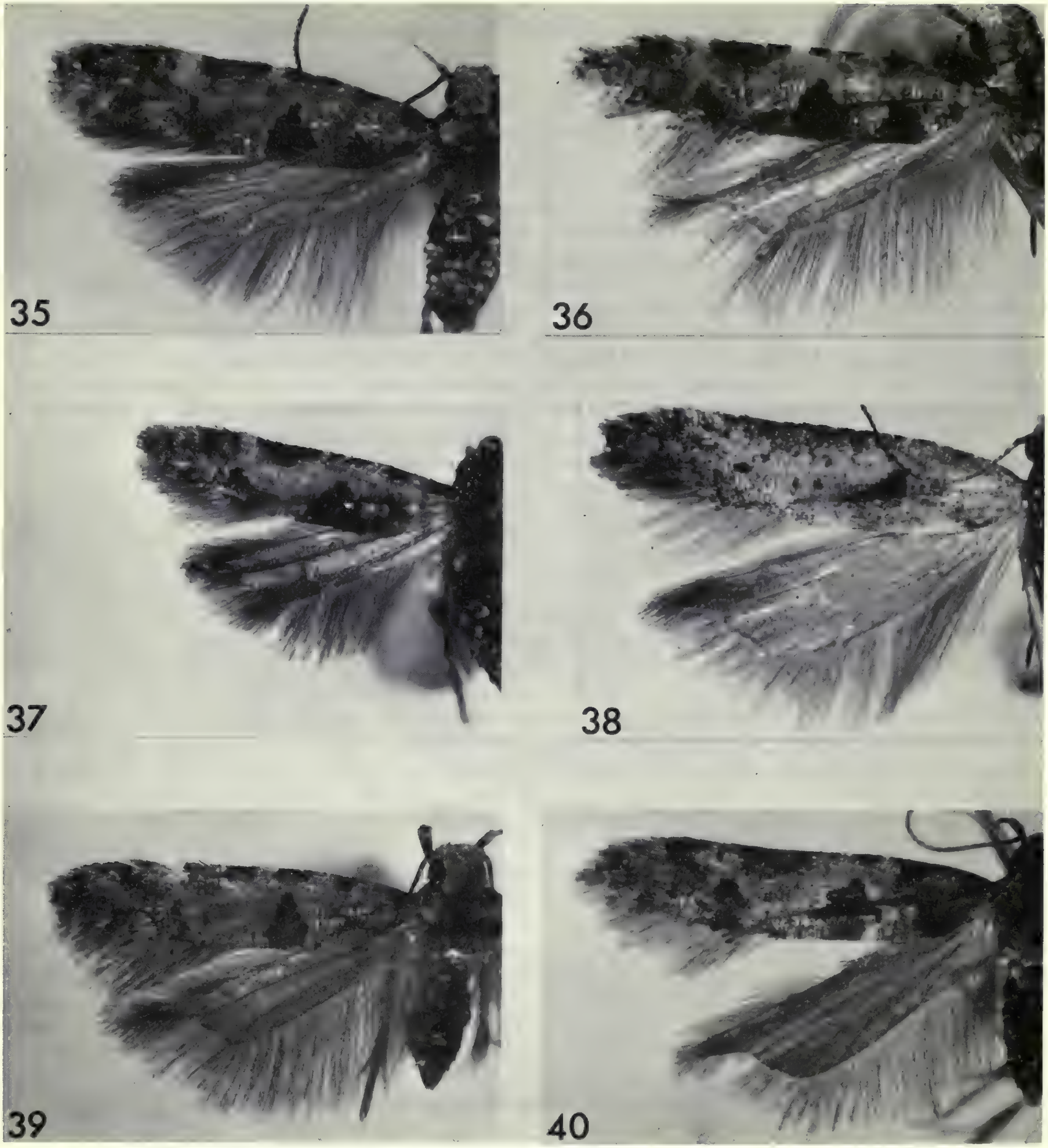
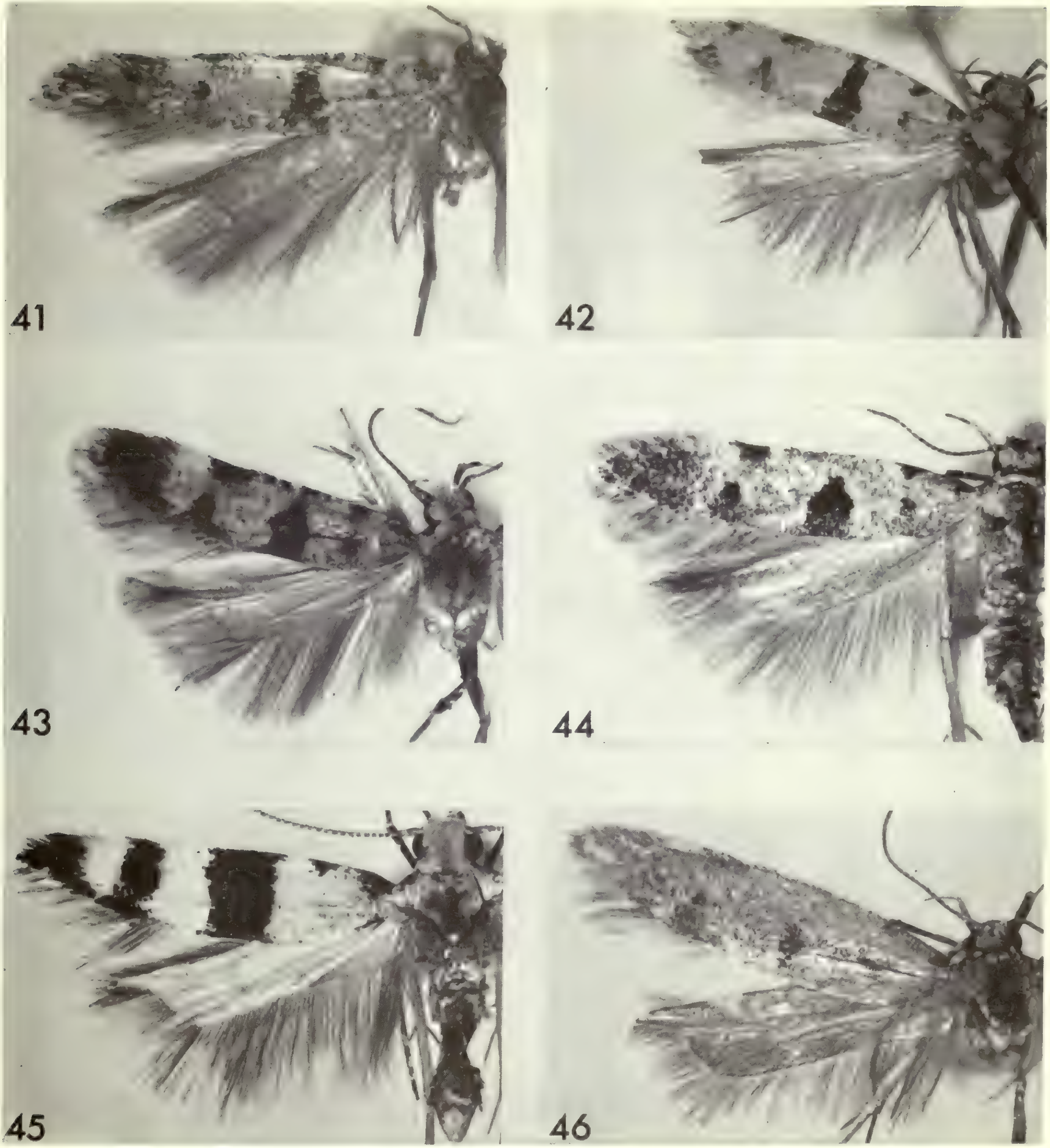
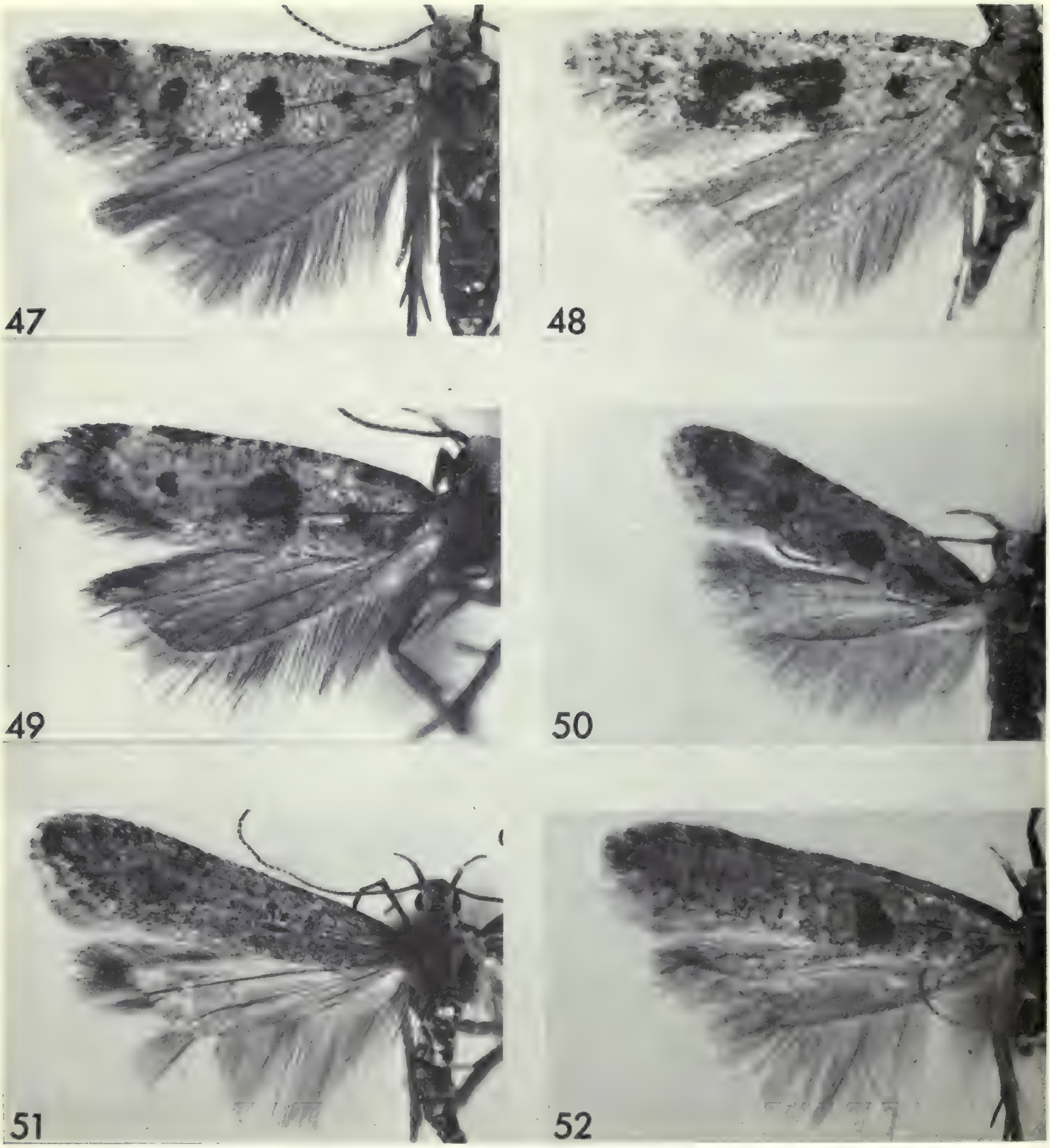


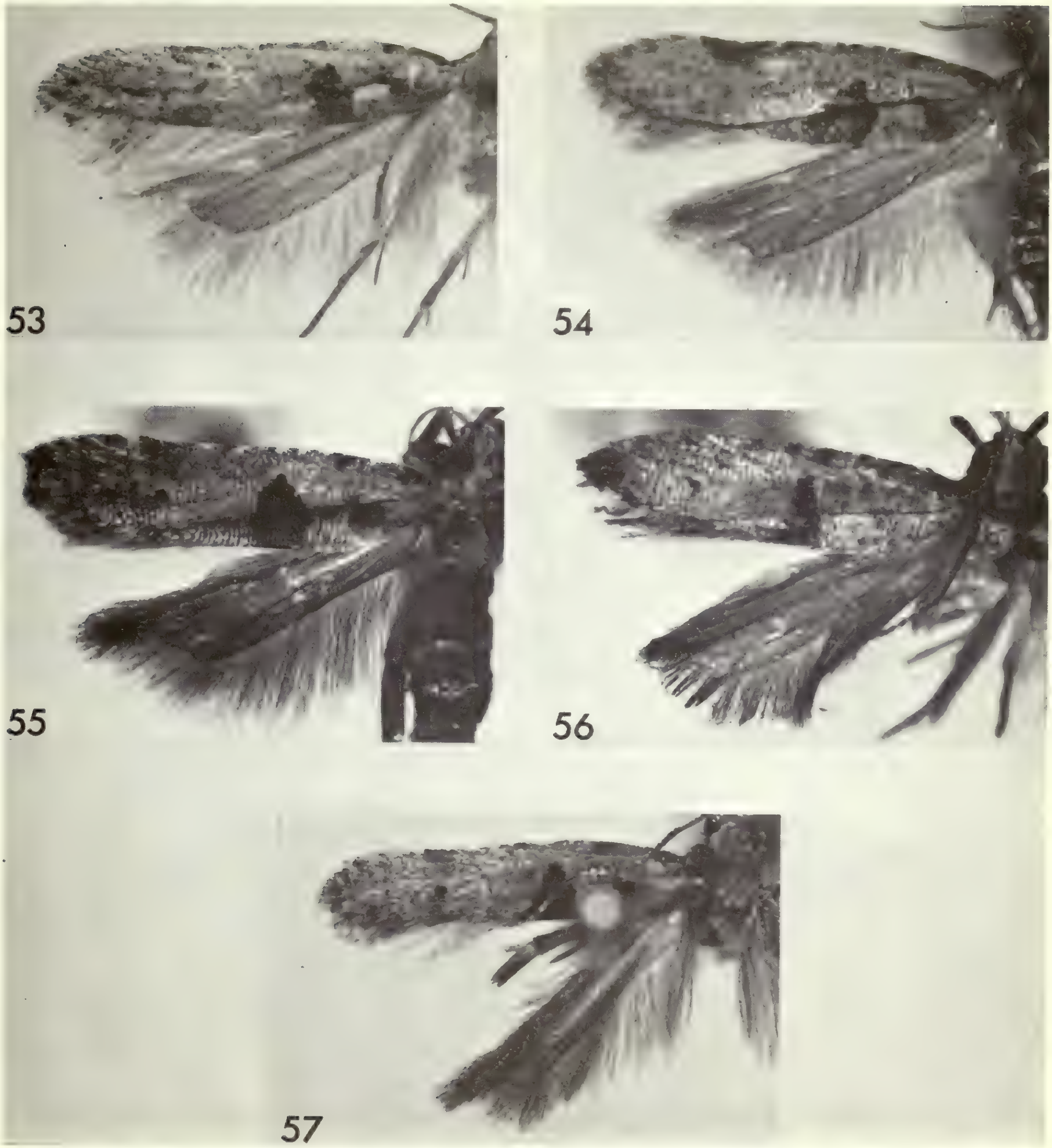
Figs 35–40 Wings of *Deltophora* species. 35, 36, *D. typica* sp. n. (35) ♂, paratype, South Africa (TM, Pretoria). (36) ♀, paratype, Nigeria (BMNH). 37, *D. diversella* sp. n., ♂, paratype, Kenya (BMNH). 38, *D. angulella* sp. n., ♂, holotype, Kenya (BMNH). 39, *D. peltosema* (Lower), ♂, Australia (BMNH). 40, *D. distinctella* sp. n., ♂, holotype, India (BMNH). [Right wing, image reversed.]



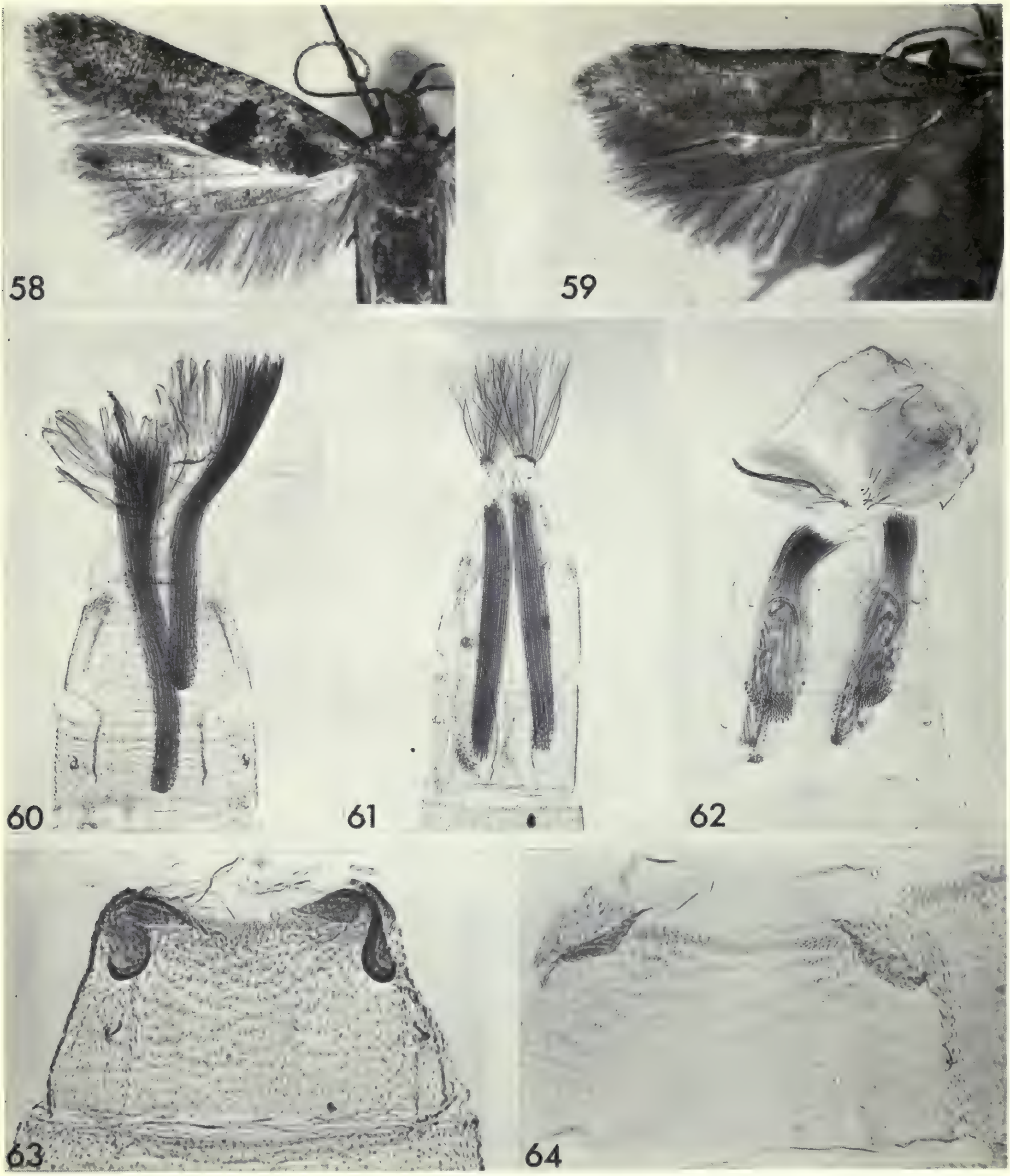
Figs 41–46 Wings of *Deltophora* species. 41, 42, *D. fasciella* sp. n. (41) ♂, holotype, Saudi Arabia (BMNH). (42) ♀, paratype, Israel (LN, Karlsruhe). 43, 44, *D. maculata* (Staudinger). (43) ♂, U.S.S.R. (BMNH). (44) ♀, Afghanistan (BMNH). 45, *D. beatrix* sp. n., ♂, holotype, Iran (NM, Vienna). 46, *D. pauperella* sp. n., ♀, holotype, India (BMNH).



Figs 47–52 Wings of *Deltophora* species. 47, *D. stictella* (Rebel), ♀, Spain (BMNH). 48, *D. stictella* (Rebel) ab., ♀, Spain (BMNH). 49, *D. korbi* (Caradja), ♂, holotype, U.S.S.R. (MINGA, Bucharest). 50, *D. sella sella* (Chambers), ♂, U.S.A. (NMNH, Washington). 51, *D. sella atacta* (Meyrick), ♂, U.S.A. (NMNH, Washington). [Right wing, image reversed.] 52, *D. sella californica* subsp. n., ♀, paratype, U.S.A. (BMNH).



Figs 53–57 Wings of *Deltophora* species. 53, *D. glandiferella* (Zeller), ♂, lectotype, U.S.A. (BMNH). 54, *D. flavocincta* sp. n., ♀, paratype, Colombia (BMNH). [Right wing, image reversed.] 55, *D. lanceella* sp. n., ♀, paratype, West Indies (BMNH). 56, *D. caymana* sp. n., ♂, paratype, West Indies (BMNH). 57, *D. minuta* sp. n., ♀, paratype, Brazil (BMNH). [Right wing, image reversed.]



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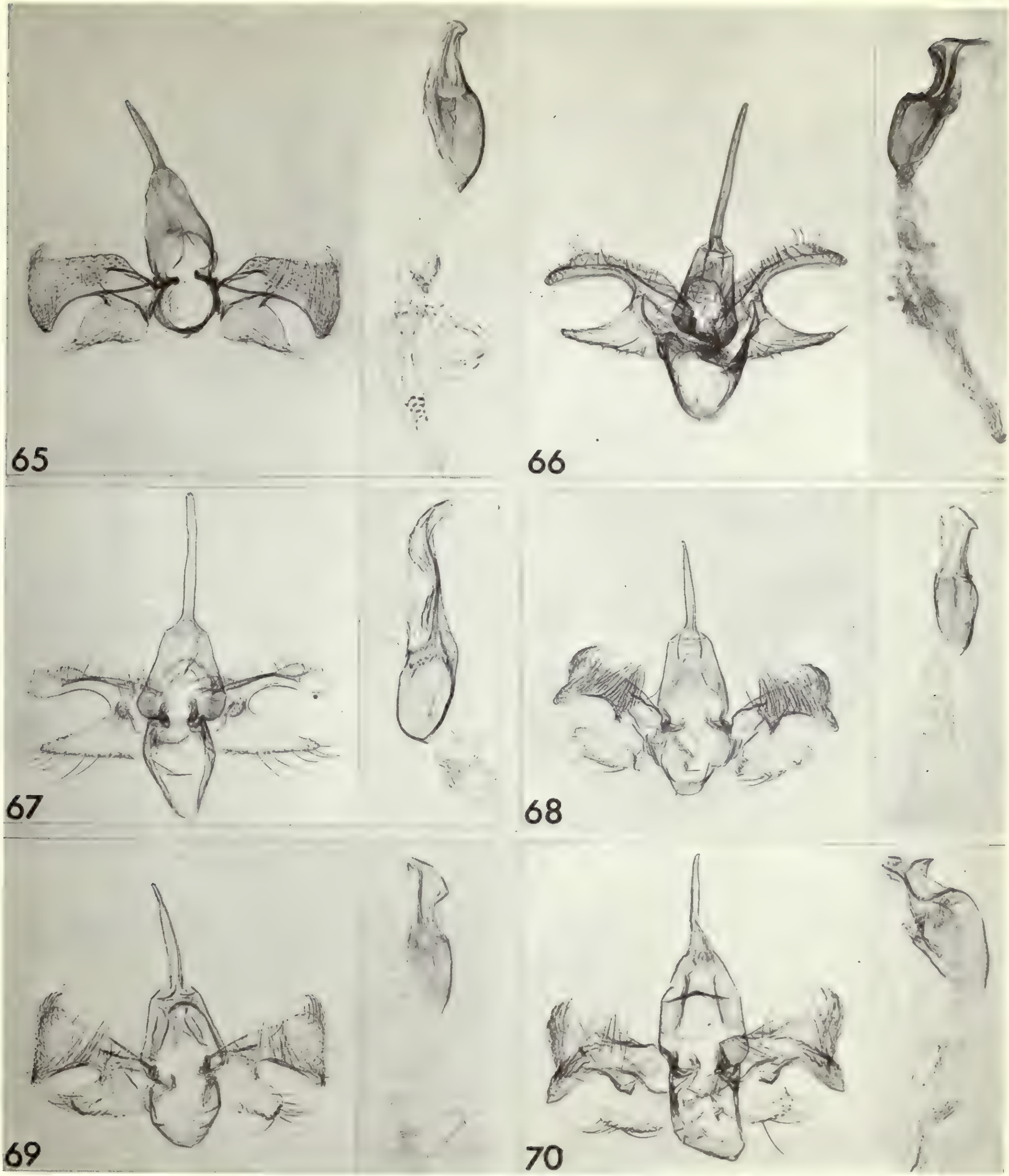

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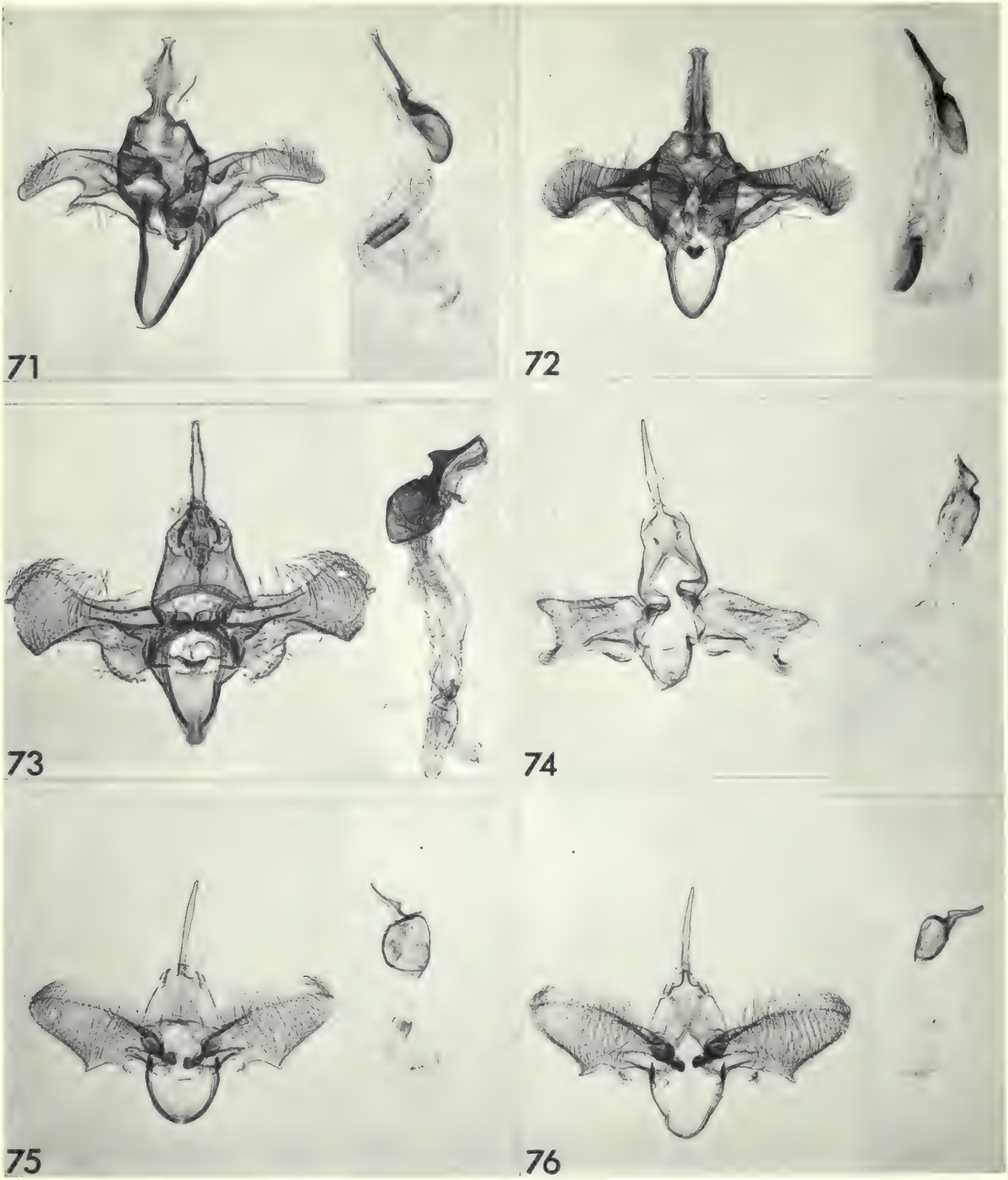

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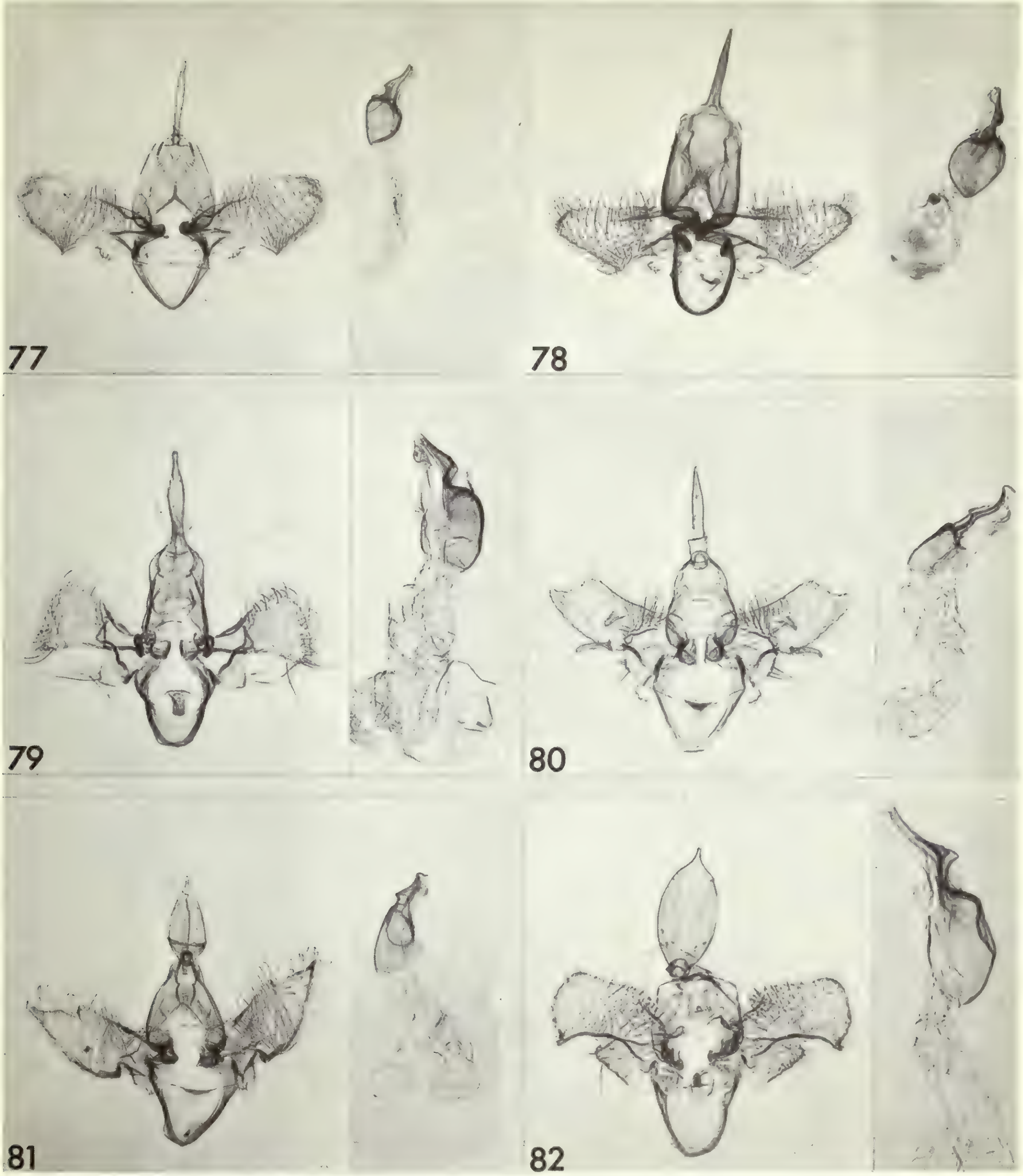

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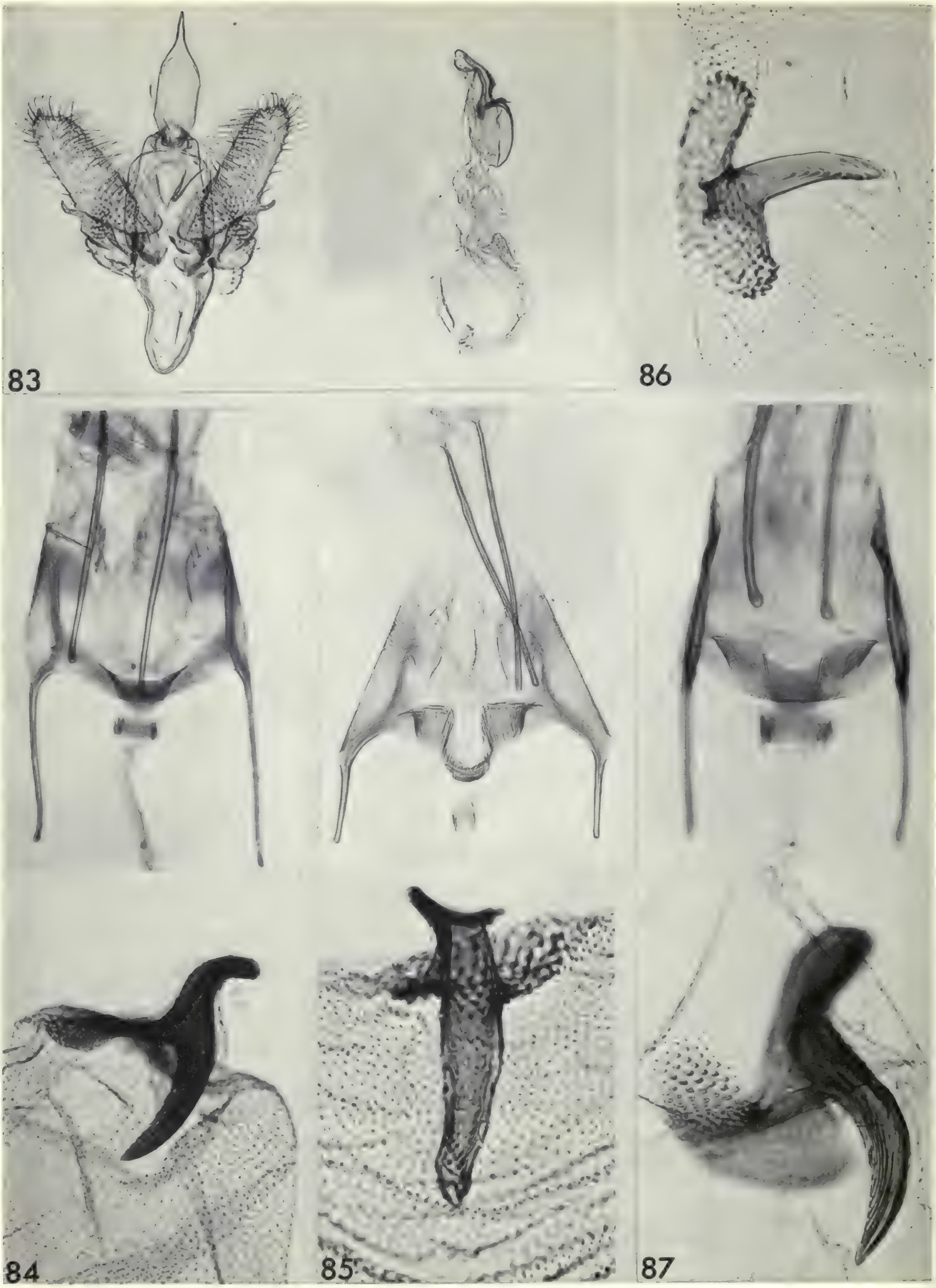

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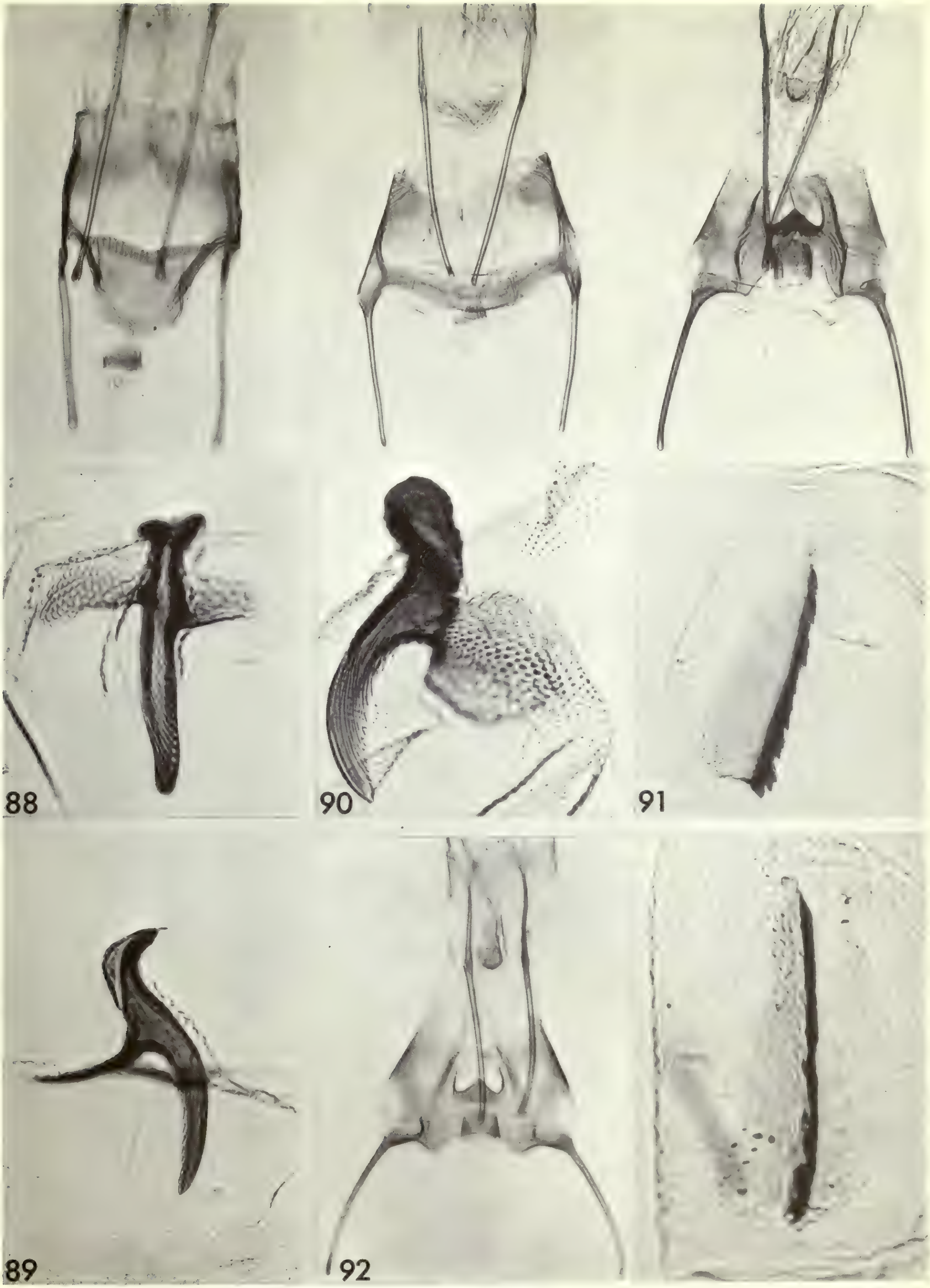

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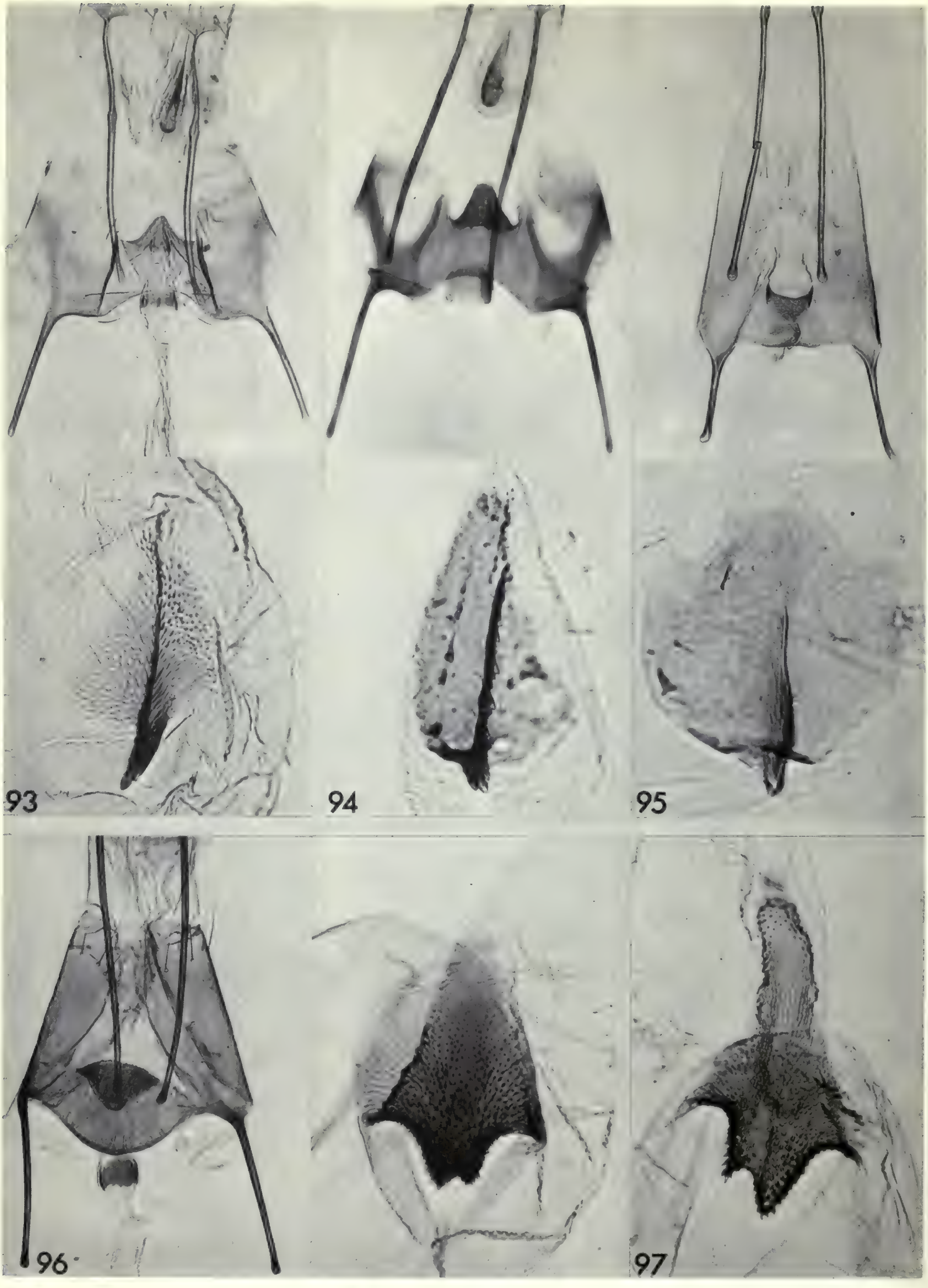

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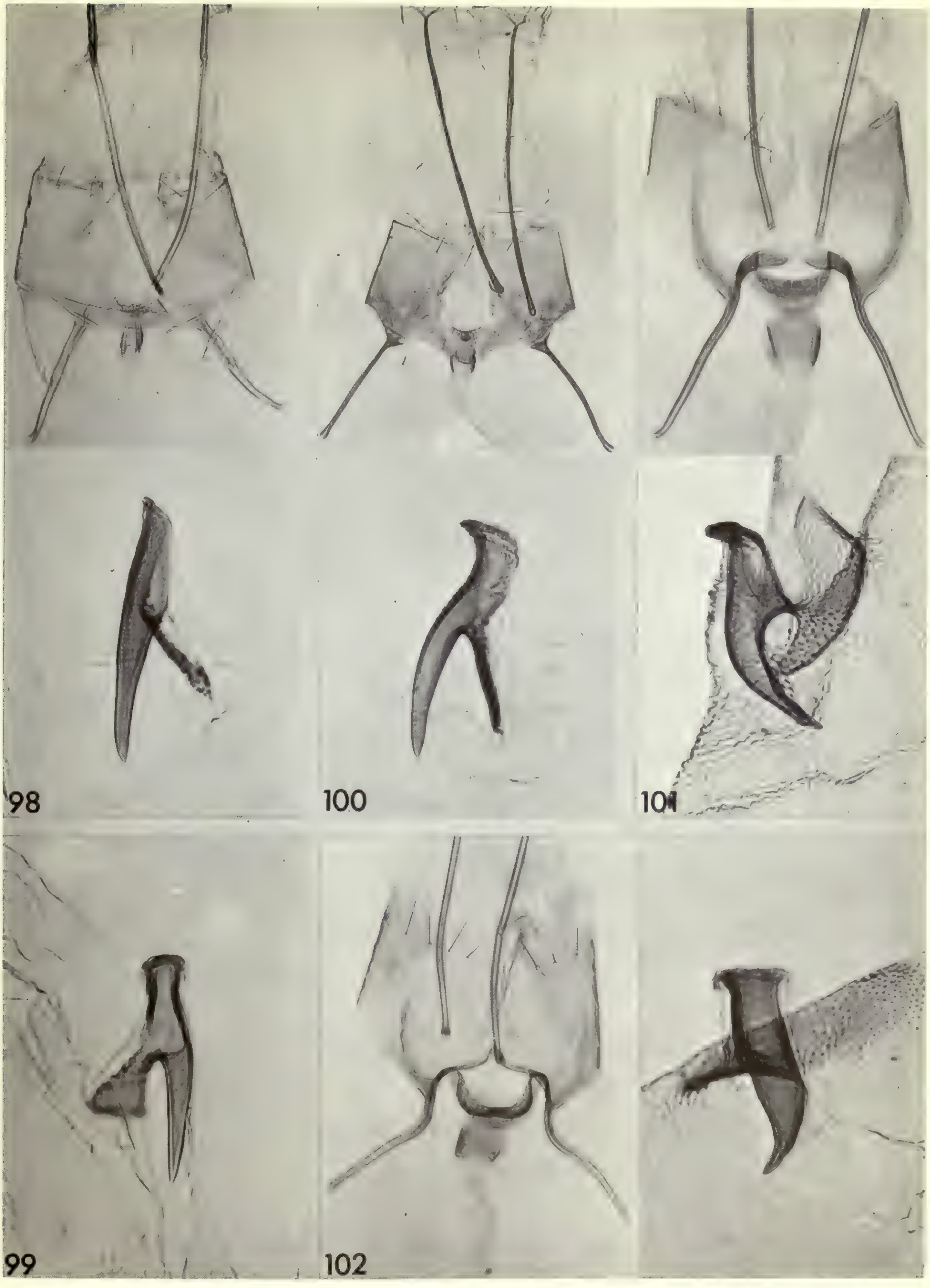

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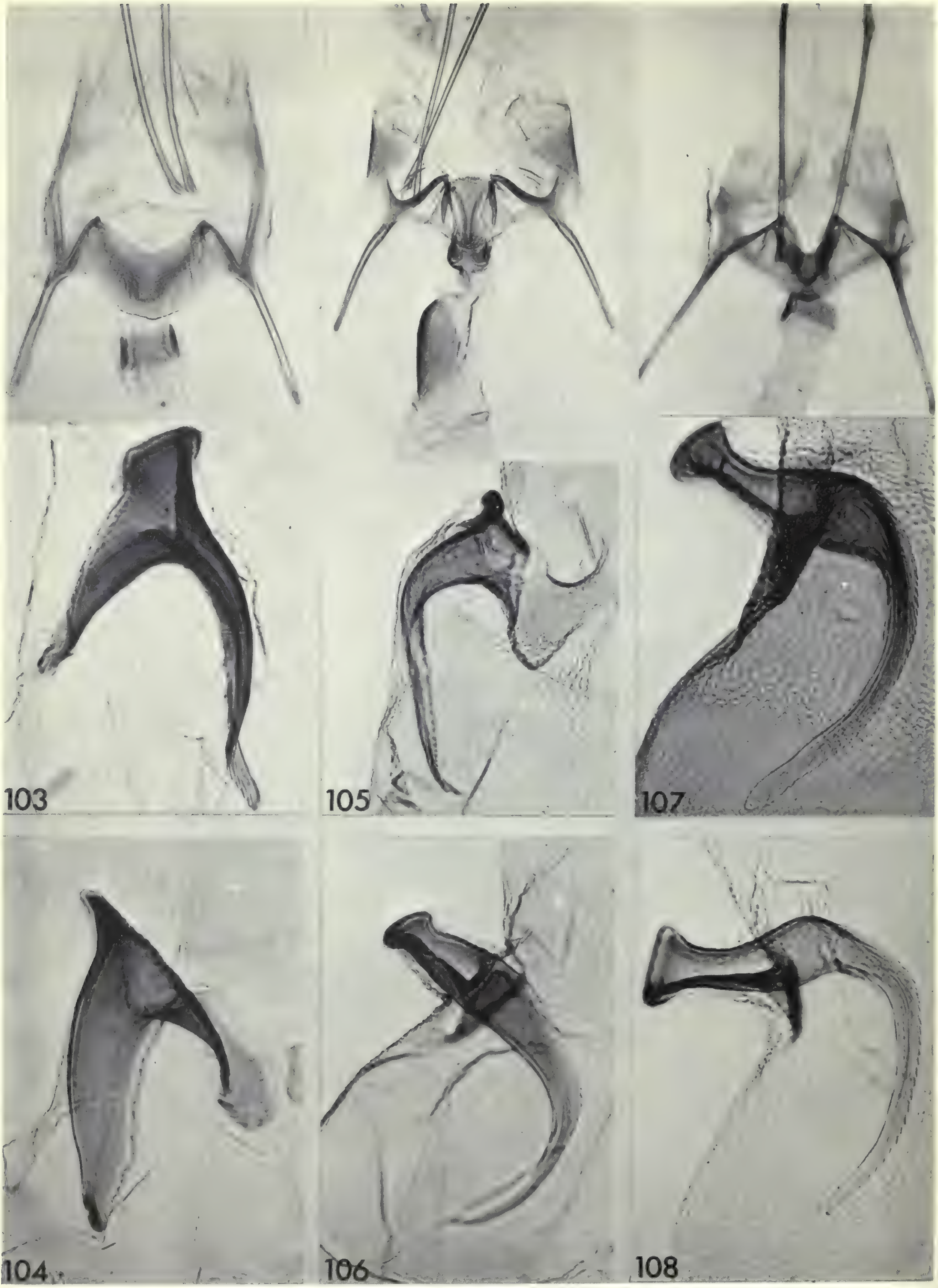

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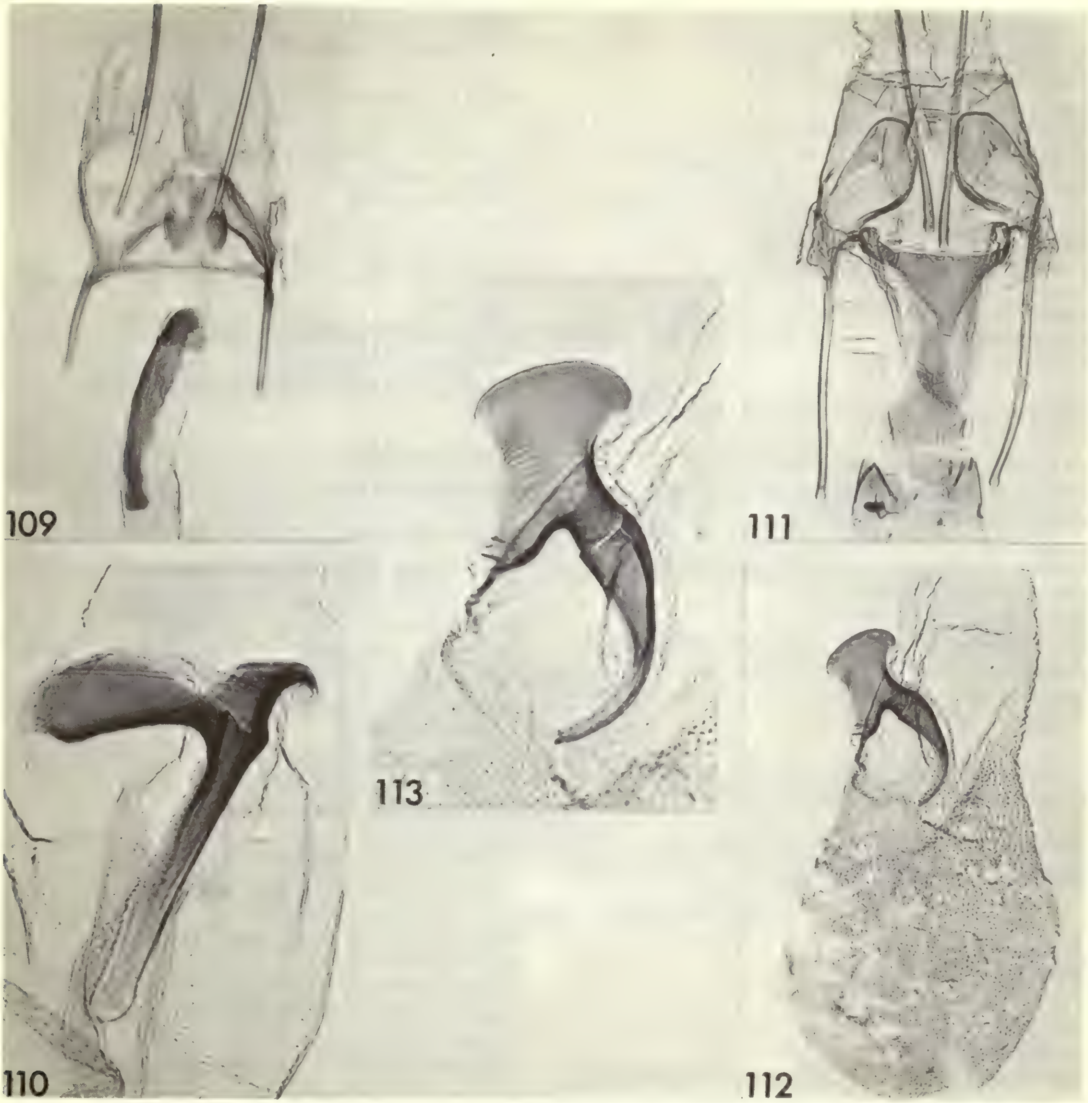

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